The
Electrical Review

VOL. CXVIII. MARCH 6, 1936. No. 3041.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY. Price 6d.

THE ELECTRICAL REVIEW, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

Telegraphic Address: "AGEEKAY, SEDIST, LONDON." Code, A B C. Telephone No.: Waterloo 3333 (50 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades and has by far the largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank."

Classified Advertisements-Official Notices-Tenders—Supp. 17.

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Rural Supply Conditions

SERIOUS attempts at electrification of the countryside, apart from a few pioneering schemes, have been made only within the past six or seven years, during which the mileage of extra-urban distributors has been increased manyfold. Electricity can now be made available—on terms—to the large majority of the rural population, as Mr. A. C. Cramb (director of E.D.A.) pointed out in *The Times* recently. That the terms may be regarded as onerous by many is evident from the complaints of other correspondents.

One factor in securing availability that has been helpful hitherto, but may lead to difficulties later, was recently referred to by Mr. C. A. Cameron Brown and Sir Philip Dawson, *i.e.*, the tendency to regard a rural area merely as an extension to the area of a large undertaking, which by absorbing the adjacent more densely loaded country removes the inducement for serving the sparsely populated districts beyond.

It is usually necessary, however, for the development charges of rural supply to be carried by an established undertaking of some kind. On this aspect particulars of the Bedford and Norwich demonstration areas given in the annual report of the Electricity Commissioners (reviewed in this issue) are illuminating. These schemes have been afforded Government assistance with a view to providing for comprehensive electrification within a couple of years or so.

While the revenue obtained four or five years after their inception is far greater than pessimists would at one time have believed possible, neither scheme is yet self-supporting (even though no expenditure has had to be incurred in providing generating stations) and is not likely to be so in the early future.

This result was not unexpected, in spite of active load building which has led to a consumption of 420 kWh per head of population in the Bedford demonstration area, where 72 per cent. of the premises are connected, and 69 kWh per head in the Norwich area, where 58 per cent. are connected, most of very low rateable value. The magnitude of the Bedford consumption is due largely to the preponderance of a brickworks load, which cannot be regarded as typical, but some power load—such as local pumping—is to be looked for.

In the Norwich scheme, the industrial load takes eight per cent. of the total kWh sold, which is perhaps representative. The significance of the other proportions of twelve per cent for farms (including farmhouses) and eighty per cent. for domestic and shop premises is that rural electrification has proceeded on other lines than once seemed likely. Even on the farms the domestic load provides the greatest field, as a rule; hence the importance of the part played by the hire of household appliances.

The inference to be drawn is that while, on broader issues, it may be inexpedient to charge for electricity supplied to rural areas prices so much in excess of those in force in towns as immediate economic conditions would warrant, the countryman should not regard it as his right to be subsidised in this way. Still less should the townsman who can afford to seek the amenities of country residence expect all the advantages, such as cheapness of electricity, which console the dweller in more populous districts.

The Bradford Bottle-neck

As a public inquiry is to be held into the shut-down at Bradford, reported by us last week, discussion of the possible cause of the fire that destroyed the main high-voltage switchgear and also covered up all traces of its own origin would at this stage be of little value. Whatever it may have been, the outstanding point is not that the supply failed, due to breakdown of some item or other of plant, but that some important industries were without power for a week—and this despite the unremitting labours of the staff, the neighbourly spirit shown by other undertakings, and the courageous putting into service of obsolete gear. Even if the power station itself had gone up, which did not happen, the grid should have been able to relay the 40,000 kWh required in Bradford from other large stations in the dis-

trict. All the power, however, had to go through the bottle-neck of the destroyed bus-bars. The most important result of any inquiry will be the light it throws upon the soundness or otherwise of present ideas as to what constitutes adequate physical sectionalisation of switchgear. The reconstruction of the h.v. switchgear at Stuart Street station, which is described in this issue, is no doubt the forerunner of work of similar character elsewhere. One grain of comfort from the Bradford disaster is that supply was restored in one part of the town just in time to prevent a three-weeks' closing of a works whose private plant had broken down.

A Prosperous Company

THERE can be few electricity supply authorities with better prospects than the North Metropolitan Company, whose 1935 report is reviewed in this issue. Its area is one that is developing at a very rapid rate—no doubt due, to a great extent, to the company's own efforts. Last year its sales of energy rose by 17 per cent., a figure substantially above the national average, and the standardisation of the "unit" charge of the two-part tariff at ½d. as from February 1st is bound to have an accelerating effect. The increased output was largely due to the connecting-up of new consumers, whose number rose by 16.4 per cent. Thus there appears to be great scope for larger sales to existing consumers—intensive, as well as extensive, development. As to finance, the company sold to present stockholders £678,737 of new ordinary stock at double the nominal value, and it is seeking Parliamentary powers to increase the authorised capital by £3,000,000 and to extend its borrowing powers. The present authorised capital is £5,000,000, of which £4,181,508 has been issued, and there is £1,449,040 of loan capital outstanding.

The Central Board's Prices

IN the course of his speech last Monday to the shareholders of the Midland Counties Electric Supply Co., the Chairman, Mr. George Balfour, reported the continued steady progress of the company. He again made reference to the company's dealings with the Central Electricity Board, complaining that the energy exported to the Board resulted in a loss to the company. He maintained that the effect of the 1926 Act had been to benefit those supply authorities who had lagged behind in development at the expense of the more efficient undertakings, and said that they continued to hope that the Act would be amended "to give effect to the definite assurances which induced Parliament to pass the Bill into law." This matter was also raised by Sir Francis Fladgate at the annual meeting of the London Power Co. last month, when he said that representations had been made to the Board by the Incorporated Association of Electric Power Companies, and he believed that the Board would soon decide what course it would take in the matter. It certainly would appear that some of the companies have a grievance, and the Board's decision will be awaited with interest.

T.C. & M. Improvement

LAST Tuesday's annual meeting of the Telegraph Construction & Maintenance Co., Ltd., was the first since the separation of the company's submarine cable business from the rest of its activities. In this direction the company combined with Messrs. Siemens Bros. & Co., Ltd., to form Submarine Cables, Ltd., for the purpose of manufacturing "submarine cable having insulation of a plastic material such as gutta-percha." Mr. Colin F. Campbell (the chairman) stated at the meeting that the new company had made a promising start, and had already received several satisfactory orders. The beneficial effect of the arrangement upon the affairs of the parent company is reflected in the accounts. The purely trading account showed a profit of £9,000 for the year, which compares with substantial losses in the four preceding years. Following an improvement in cable prices, the prospect of the company's new venture, the production of power cables, is held to be good; the metallurgical department is prospering; and the scope for special cables for radio relay systems is extending. Thus, in spite of the burdens imposed upon the company by the Selborne Plantation and the cable ship *Dominia*, Mr. Campbell considers that the company has at last turned the corner.

The First of April

THE prophecy of a raid on the homes of electricity consumers for the purpose of inspecting (and, it seems, generally condemning) the wiring of six million houses that appeared in a Sunday newspaper is likely to be misleading. We suppose April 1st was given as the day on which the search warrant would become operative, not so much on account of its usual associations as because that date was once provisionally fixed by the Electricity Commissioners for the coming into force of the retrospective provisions of their Electricity Supply Regulations, 1934. By a memorandum of December 19th last, however, the date was postponed until January 1st, 1937. In any case, refusal to give a supply, if a few simple safety requirements are not met, is permissive, and not compulsory. The implication that an installation must comply with the I.E.E. Wiring Regulations is incorrect; these are mentioned only as providing an approved standard. An undertaking may disconnect an installation when the leakage current exceeds a specified value, or if it causes interference with the supply to other consumers, but except in case of emergency reasonable notice has to be given, and the consumer is adequately protected against abuse of authority. It is a pity that an article of this kind (since it presumably was not "hot" news) could not have been referred to an electrical engineer with knowledge of the subject or to the Commissioners themselves.

Poplar's Example

THE still-prevalent idea that electricity is too expensive has received another blow—this time at Poplar. A week or two ago the Electricity Department ran a four-day programme of demonstrations to extend the use of electricity in the home, and as a result 318 cookers, 285 water-heaters and 64 wash-boilers were ordered. Prior to this there were already on the mains about 3,000 cookers and 750 wash-boilers. The point of the whole matter is that Poplar is anything but a "well-off" neighbourhood; the bulk of the inhabitants are people who have to look at every penny before parting with it. Nevertheless, they find electricity worth while spending money on, which means that it is capable of doing their cooking and water-heating as economically as any other means. We congratulate Mr. R. Illingworth, the borough electrical engineer, on a good practical development effort, which is worthy of emulation by other undertakings who up to now have not realised the possibilities.

Spreading the Light

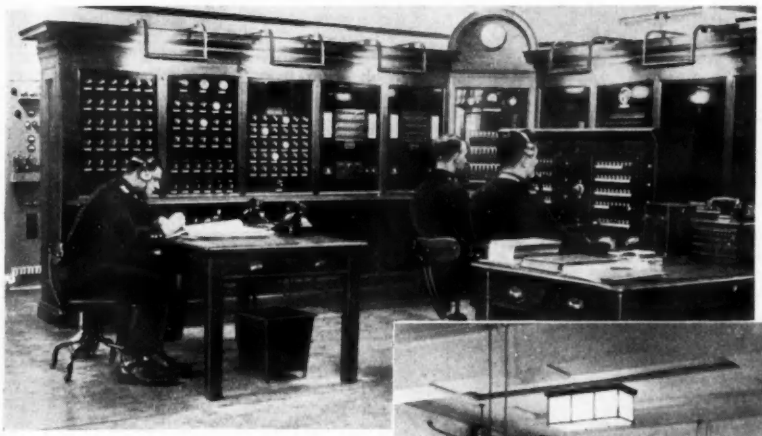
WHILE we continue to devote attention to the electrification of the home and industry we must not forget that one of the earliest applications of electricity—lighting—is still the most important. Electric lighting is coming to be accepted as inevitable nowadays, even if gas is used for other purposes, but it does not follow that there is nothing further to be done. Even to-day in hundreds of thousands of homes and factories ideas regarding illumination are primitive. It is the task of the Lighting Service Bureau to remedy this state of affairs, and the object is a worthy one. During the current lighting season the Bureau has been very active—particularly among architects, whose acquaintance is worth cultivating by all branches of the industry. The touring demonstration van has covered a wide area in Southern Scotland, and is now about to commence a tour of the North-East Coast. A new edition of the Bureau's "Architectural Lighting" handbook has been produced as the first of a series of new and revised publications.

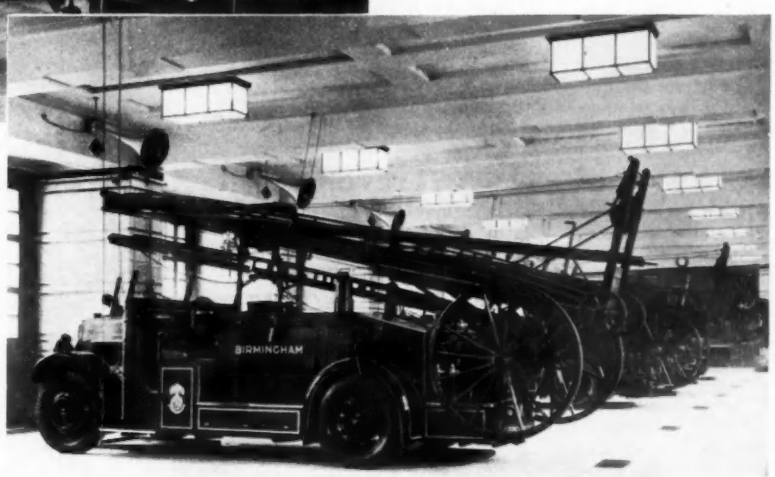
A Modern Fire Station

The new Birmingham brigade headquarters

EMERGENCY operation and security are the keynote of the electrical installation at the new Central Fire Station and Brigade Headquarters which have been erected at the junction of Corporation Street and Aston Street, Birmingham, at a cost of over £150,000. In addition to an immediate turn-out of eleven fire machines, the station comprises workshops and offices and firemen's living accommodation.

An 11-kV supply from the Birmingham undertaking is taken to two main "Botrade" l.p. distribution boards at different points, thus safeguarding against a complete shut-down within the limits of the distribution scheme. Lighting and "small plant" is supplied at 230 V, single-phase, while normal-size motors are served at 400 V, three-phase.

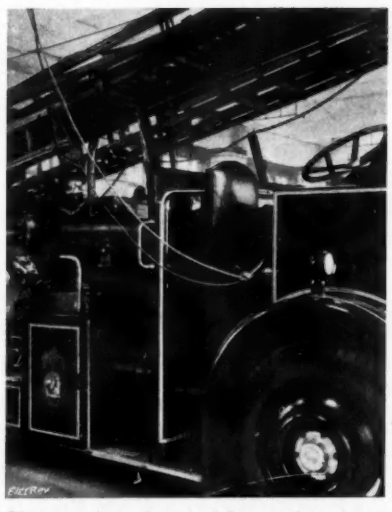




The control and telephone boards, and (right) Holophane "Hedralite" lighting in the machine room

Utility without harshness is the impression made by the general lighting, which is provided by totally enclosed opal spherical ceiling-drop units. Heavy metal three-point pendant fittings with small opal inverted shades are employed in the Committee Room, while at some points, such as in stairways, we saw some multi-cylindrical type fittings, several lay-lights in the arch-shape ceiling of the recreation and school room being semi-spot-lighted by suitably focused intensive reflectors in the garret. The outstanding feature of the illumination scheme, however, is in the machine room, where "Hedralite" ceiling fittings are installed, each being fitted with three 100-W lamps and a special Holophane prismatic reflector.

In the machine room remote starting of the engines and supplies for the engine radiator heaters are provided for by c.t.s. leads from special ceiling points. For the engine warming 1-kW immersers are permanently built into the engine radiators and wired to convenient plug-and-socket connectors. The immersers have incorporated thermostats which are normally set at 100 deg. F.



Close-up view of part of fire engine, showing self-starting and immersion-heater leads to ceiling

Opening of the machine-room doors is governed from the control room. Actually each pair of doors is operated by a descending weight, but in the normal "doors-closed" position the weight is suspended by a simple clutch, which can be released from the control room by closing the circuit of a solenoid unit located immediately over the weight. Over each pair of doors is a loud-speaker by which instructions as to the location of fires are given from the control room, and red lights over the doors indicate which machines are to turn out. Under each machine is a grating through which fumes are drawn by a motor-driven fan.

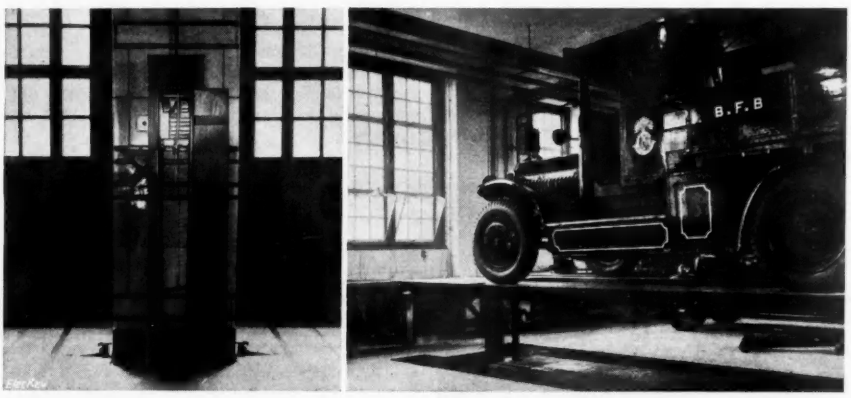
Throughout the station there are 67 alarm bells which are normally operated at 230 V a.c., but can, however, be battery operated at 110 V d.c. in case of emergency. Duplicate banks of batteries also provide the current for the street-alarm system. Forty alarm posts within about a square mile of the centre of the city are connected with this station, and the batteries come into use only after the door-operated ratchet actuates the magneto in the street-alarm head and gives the initial alarm. There are two tiers in each battery group, the top one consisting of h.t. and l.t. batteries for the loud speakers and the l.t. bottom unit serving the speaking circuit of the alarms. For charging these batteries there is a hand-controlled metal rectifier with outputs of 2.5 A, 2.5 A, and 0.125 A at 7.5 V, 32 V and 180 V respectively.

Arranged in vertical-plane panel formation in the control room are several groups of operating and control equipments. Red, white and green signal lights in the machine room indicate tender, pump and examining unit required respectively, and in the group of switching for these are included time-lag release switches for the engine starting and flicking switches for the machine-house door-opening equipment. The control gear for the Carter-Micro street-alarm system includes simple telephone-exchange type indicators, switches to put the telephones in circuit and red and white lamps to show earth and disconnection faults. The installations of a good many contributors to the Pearson's automatic fire-alarm system in the city are connected to a separate panel *via* telephone lines. There is also a control panel for the G.E.C. amplifying equipment in this room, which serves the loud speakers in the machine room. A card index system of all the buildings and streets in the City where h.v. electricity is used permits the quick notification of the electricity undertaking of a fire in the vicinity of any h.v. supply. On the station's private telephone exchange there are direct lines to all the theatres and cinemas in the city.

Two interesting heating and ventilating schemes include that for the recreation rooom in which fans (5 h.p. s.c. motors) in a duct system in the roof draw air from the room and thus induce air through air bricks in the walls, the air passing over hot-water radiators before it enters the room. In a somewhat similar scheme for the workshop, fans blow air through hot-water radiators which can be so arranged that the air flow is directional.

To eliminate vibration on account of the living quarters above,

none of the several workshop plant units which contribute to the total 55 h.p. in independent drives is suspended from the ceiling. One size of motor 2-h.p., is standard for the individually driven lathes, polishers, grinders, shaping and drilling machines. All these motors are s.c. machines and are directly switched on the line with direct change-over switching for reversing and isolating switches built on to the driven machines. The engineer spoke enthusiastically of the advantages of this scheme by virtue of the elimination of reversing belts and fast and loose pulleys.



The remotely controlled door-opening gear, and (right) a breakdown lorry on the hydraulic lift in the workshop

Apart from the individual drives, compactness is obtained in other ways for some of the larger equipment. For a 9-ton hydraulically operated machine lift the pumping gear and tank and the driving unit are all housed under the mechanic's wall bench, so that no working space is utilised. This lift was made specially to the station's requirements, and is believed to be the first 9-ton double-ram lift to be installed. The rams are synchronised by interconnection with rack and pinion and not by equalising water valves. Lifting the fire machines for examination and repairs of the engines is the function of this equipment. A 2-cwt. forging hammer is self-contained with its air compressor for pneumatic operation and the motor drive. The whole unit is mounted on an 18-ton concrete block 4 ft. deep on three sets of laminated springs *via* girders, so that it is entirely isolated from the main floor.

In the drivers' school room motor-driven sections of engines and pumps provide excellent instructional equipment, and here again we saw direct on and off switching by push-button units for a 2-h.p. motor. Some of the larger motors have star-delta control, the forging hammer representing one instance of this. A master clock in the control room operates slave dials in every room throughout the station, including the tower clock which has its own circuit and relay. The installation work was carried out by Messrs. Walker Bros. (Electrical Engineers), Ltd., of Birmingham.

A Travelling Rectifier Sub-station

FOR the electrification of the main railway line system of the Companhia Estrada de Ferro Oeste de Minas in Brazil, which is operated by d.c. at 1,500 V, the Siemens-Schuckertwerke, Berlin, supplied, among other equipment, the electric locomotives and the glass-bulb rectifiers for five sub-stations, the power supply for which is drawn from a 33,000-V, 50-cycle a.c. distribution system. A stipulation was that one of the sub-stations should be transportable, so as to be able to act as a stand-by for any of the permanent sub-stations in case of breakdown or repair work, and also for the supply of power to any part of the line which was temporarily overloaded.

Each sub-station is equipped with the necessary h.v. a.c. input switchgear, one rectifier unit rated at 750 kW continuous and 1,000 kW for three minutes (comprising the main transformer and three glass-bulb rectifier cubicles) and the l.v. d.c. output switchgear for two track feeders with supervisory short-circuit protection. The attendance at the fixed sub-stations is usually limited to the daily closing and tripping of the main oil circuit-breaker at the beginning and end of the working day. There is thus no need for an attendant to be at the sub-station all the time, the necessary switching operations being carried out, in addition to his normal duties, by an official from the neighbouring railway station.

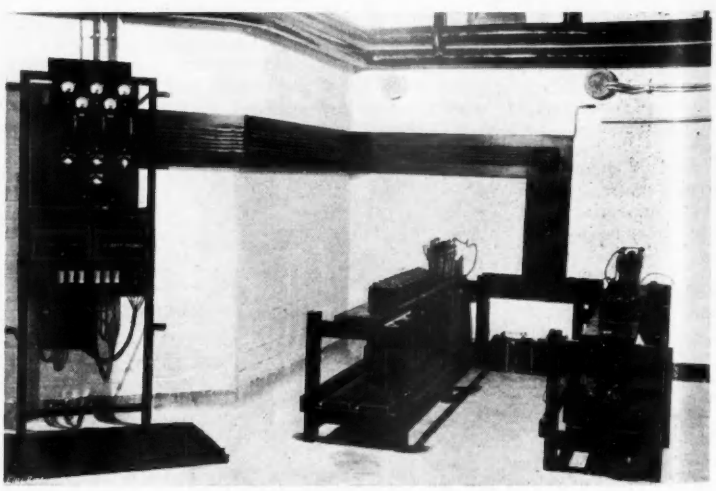
The track feeder breakers trip and reclose automatically in the event of short-circuits, and only when the fault persists is it necessary for the station official, summoned by an acoustic signal indicating the presence of the fault, to proceed to the sub-station. Under the conditions obtaining in Brazil, the rectifier bulbs operate at 166 A, 1,500 V continuously and can carry overloads of up to 250 A for limited periods.

The travelling sub-station externally resembles an ordinary goods van. Except that only a single track feeder is provided, the equipment is the same as that of the fixed sub-stations. The h.v. supply is brought in through three bushings in the roof to the oil circuit-breaker and metering instruments at one end of the vehicle. The transformer compartment comes next, and then the rectifier cubicles, arranged in two rows straight across the vehicle. Two of the rectifier cubicles are placed side by side and are faced by the third one and the track-feeder cubicle. A gangway running straight across the vehicle is therefore left for attending to the d.c. side. A second gangway which gives access to the auxiliary circuits is provided in the oil circuit-breaker compartment.

Replacement of the glass bulbs can be effected from the gangway. The vehicle is provided at both ends with double swing doors, the front ones leading to the operating side of the oil circuit-breaker and auxiliary circuits, while the rear pair provides for making the d.c. connection to the overhead line by means of a short length of cable. A door in one of the side panels allows the oil circuit-breaker to be wheeled in and out when necessary, a hinged steel frame being provided in the vehicle for this purpose. A door is also fitted at the entrance to the rectifier compartment. Both sides of the transformer compartment are closed by perforated panels in which small inspection doors are fitted. The cooling air for the transformer and rectifier bulbs is drawn through holes in the side panels, while the warm air passes out through suitable openings in the roof.

The earthing cable for the equipment is arranged so that it can be clamped to the rail at any desired point, a specially designed adjustable rail clamp being provided for this purpose.

The rectifier bulbs are spring-suspended in their transport frames, the latter being also further spring-suspended inside the rectifier cubicles, an arrangement which, in conjunction with the special springing of the vehicle, prevents any bulb breakage when the travelling sub-station is in motion.



Duplicate batteries for street alarms at the new Birmingham fire station, with charging equipment on the left

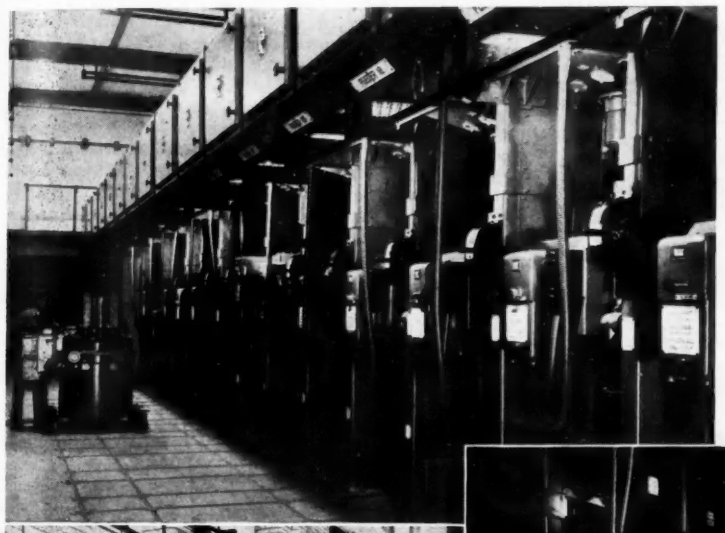
Modifying Switchgear.

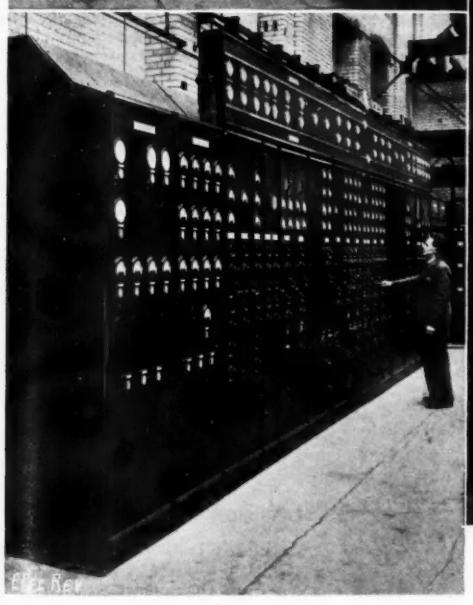
By W. Kidd, M.I.E.E., and A. J. Nicholas

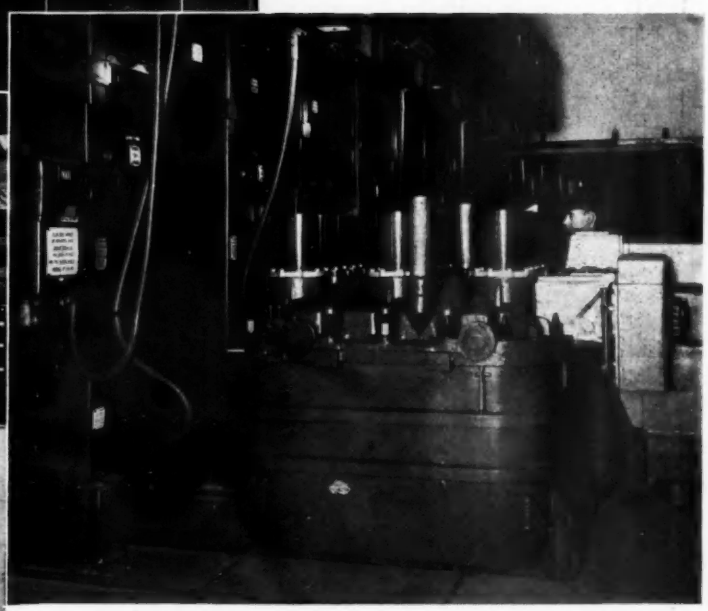
The installation at Stuart Street Station, Manchester

THE name Barton has been so prominent in association with Manchester Corporation Electricity Department that Stuart Street generating station has been somewhat overlooked, although it was once the largest station in the country and now has 127,000 kW of plant installed, compared with 106,750 kW in 1922, 37,000 kW in 1912 and 6,000 kW in 1902. Most of the developments occurred during the war, but within the past three years the station has been modernised and the new plant, which comprises six boilers, a 30,000-kW turbo-generator, two cooling towers and switchgear, is now in commission.

The growth of the station together with the construction and inter-connection of Barton station with the grid brought in their wake important switchgear problems. The Corporation decided that the existing switchgear was not suitable for the new conditions and boldly adopted the course of completely replacing the Stuart Street 6.6-kV switchgear. The new scheme was prepared by the Department's own staff under the direction of Mr. H. C. Lamb, chief engineer and manager, and embodies some novel features to ensure reliability and convenience.







Top: One of the 500,000-kVA feeder metal-clad boards. Left: Miniature type control board. Right: A section of the 750,000-kVA generator board

Eighty-five circuits were involved and the change-over has been completed without interrupting the supply to the consumers. The original switchgear was of Continental design and comprised air-break switches and "Oberspree" fuses. The Ferranti equipment which was adopted for the first extension incorporated the auxiliary oil breaker with a main air-break switch; all later extensions included oil-circuit breakers.

The facilities afforded by this arrangement for the control of power factor of the load to and from the 33-kV interconnections between Barton, the City, and Stuart Street generating stations and for the regulation of voltage on the feeder bus-bars were inadequate for present-day requirements. Independent control of each is essential for satisfactory and efficient operation of stations in parallel; further, it should be possible to have separate automatic regulation of the voltage on each section of the feeder bus-bars to ensure maintenance of voltage within reasonable limits at the consumer's terminals. Both of these matters have recently been dealt with in papers read before the Institution of Electrical Engineers.

Furthermore, the lay-out of the switching scheme needed revision to deal with the larger short-circuit power available. The increase in the rupturing capacity of the switchgear brought about a two-fold problem, and it was necessary, for both technical and economic reasons, to ensure that the short-circuit kVA, not only at the generating station, but also in the sub-stations on the system, was kept within reasonable limits. In the revised scheme the tap changers on the transformers between the generator bus-bars and the 33-kV system, which are non-automatically remote electrically controlled, regulate the power factor of the interchanged load.

The whole of the Manchester system has its voltage automatically regulated; a further step has now been taken and equipment for automatically regulating frequency and load sharing has been installed on two turbo-generators for experimental purposes. This will enable the most efficient machine to be kept on a steady load; further, the limits of automatic load variation of other machines can be adjusted to suit service requirements.

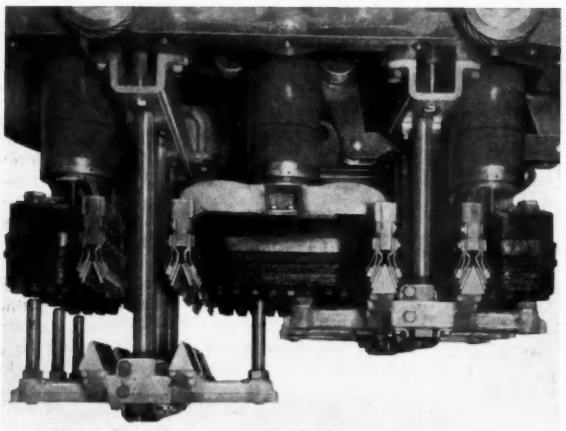
The switching scheme comprises two sections, a 750,000-kVA switchboard for controlling the generators, step-up transformers, house-service equipments and group feeders, and a 500,000-kVA switchboard for controlling the outgoing 6.6-kV cables. The feeder switchboard is divided into four sections, each fed by a main group feeder through reactors from the generator bus-bars. In addition two by-pass group feeders are provided, each capable of being connected to either of two feeder switchboards in the event of a main group feeder being out of service. The reactors in the feeder groups limit the possible fault power at the bus-bars of the feeder switchboards to less than 500,000 kVA, and in distribution sub-stations the maximum rupturing capacity of circuit-breakers need not exceed 250,000 kVA.

Each feeder group comprises a number of circuits of as near as possible similar load characteristics to facilitate automatic voltage control and to form alternative supplies to sub-stations. There are sixty-seven metal-clad units, and it is believed that this is the largest contract placed in this country for 6.6-kV metal-clad switchgear. In view of the onerous conditions of service, the specification stated that the switchgear should be capable of carrying, without damage to itself, a fault current

having an initial value 1.5 times the rated fault current over a period of five seconds. The specification also required that temperature rise tests, reliability tests of 1,000 cycles of operation, and rupturing capacity tests should be made on sample equipments. The 750,000-kVA double breaker successfully interrupted 1,150,000 kVA at 11,000 V on one breaker, the other breaker being in the open position.

The 750,000-kVA switchboard controls generators rated at 8,000, 18,000, 25,000 and 30,000 kW; two 25,000-kVA and one 15,000-kVA step-up transformers; one generator group for controlling a number of older machines connected to a subsidiary switchboard; four house-service equipments; and six group-feeder equipments. The 500,000-kVA switchboard controls the outgoing 6.6-kV feeders from the station.

The reactors which are installed in both main and by-pass group feeders are of the oil-immersed type and comprise three single-phase units in a common tank. Each set has a reactive voltage drop of 3.3 per cent. at 28,500 kVA. Each automatic voltage variation equipment (installed in the main group feeders only) is of the three-phase type and consists of a regulating transformer with an on-load tap changer and a booster



One of the 3,000-A, 750,000-kVA double-breaker equipments showing cross-jet explosion pots

transformer mounted in one tank. The equipments are suitable for 2,500 A per phase, and are designed to give a range, in ten steps, of output voltage between limits of 7,250 V on full load (0.8 power factor) and 6,300 V at no load. The tap-changing gear is motor operated and arranged for automatic control, using a voltage regulating relay and line-drop compensator with separately adjustable resistance and reactance.

The switchgear consists of two types, on-load selection for the generator sections, and off-load selection for the feeder sections. On-load selection of bus-bars is effected by means of a duplicate breaker equipment with two circuit-breakers housed in a common tank, one being closed before the other is opened; the operation is remote controlled, carried out from the miniature switchboard. Off-load selection is effected by means of a single transfer breaker which is lowered from one set of bus-bars, transferred and then raised into the other set.

All the switchgear is of the duplicate-bus metal-clad type with 3,000-A, phase-separated bus-bars; the breakers are remote controlled, electrically operated. The circuit-breakers are raised and lowered into position by motor-driven raising and lowering screws which permit both isolation of the breaker and inspection of contacts in position without withdrawing the breaker into the passage-way. All circuit-breakers are fitted with cross-jet explosion pots, in which pressure generated by the arc during the early part of the opening stroke projects clean oil at high velocity across the arc path, thus breaking the circuit at zero pause of current.

Sixteen of the twenty breakers on the generator section are of 3,000-A capacity. The contacts and isolating plugs and sockets have been "silvered" to minimise contact resistance and to give added life to the breakers. A platform running the full length of the switchgear gives access to the rack-out voltage transformers, which are located on the top of the units, and to the terminal and wiring panels. The old open flat-back control board was approximately 120 ft. long.

A miniature board, incorporating telephone-type relays and control cables with special circuit-breaker indicating equipment, was designed by the Electricity Department. The new board, which may ultimately control ninety-five circuits, is only 29 ft. long and is divided into two portions, the front half being the control board, and the rear part being the relay and voltage regulator board with a corridor between.

Each control panel is of the steel-cubicle type with hinged doors at the rear opening into the corridor. A semaphore diagram for the generator section has one illuminated lens for each circuit-breaker indication. Behind this common lens, are red, green and blue lamps which indicate the closed and open positions of the breakers and also, by flicker indication of different colours, show whether the circuit has opened on overcurrent or on leakage fault.

The most compact part of the board is the feeder control equipment for the thirty-seven feeders and incoming isolators. Each feeder is controlled by a small removable sub-panel measuring 6 in. by 9 in. on which is mounted a 4 in. dial ammeter, main and series closing and tripping switches, a common lens with multiple-coloured lamps to indicate switch positions, and flicker indication for overcurrent and leakage tripping.

To minimise the possibility of closing the wrong circuit breaker, the closing operation is effected in two stages by two series-connected control switches; only one switch is used for the opening operation.

Merz-Price circulating-current with back-up overcurrent protection is provided for the generators. Two of the power transformers are protected by "translay" equipment, while the third transformer is protected by restricted earth-leakage gear. Triple-pole over-current protection is provided on the house-service transformer switch units, and triple-pole overcurrent and earth-leakage protection on the outgoing group feeder units—the voltage variation and reactor equipments are protected separately by means of Merz-Price circulating-current protective gear, the associated transformers being housed in the voltage variation and reactor tanks. All the 6.6-kV feeders are protected by means of simple triple-pole overcurrent and leakage-protective gear.

To facilitate the testing of switchgear, plant and feeders, an a.c., 15-kV, 200-kVA test equipment, comprising transformer, regulating gear and resistances, has been installed in No. 4 feeder room. A bare copper test bus-bar is mounted on the wall of each room with central isolating links.

The switchgear is housed in a new three-storey building outside the generating station. At ground level are the voltage-variation and reactor equipments, on the mezzanine floor are cables, and on the floor above is the switchgear. The switch-house is divided by walls and fire-proof doors into seven rooms, three for the generator sections of switchgear, and the remaining four rooms for the feeder switchgear. The generator equipment is sectionalised by automatic oil circuit-breakers in the front and rear bus-bars into sections (a) and (b). These section switches are in a separate fireproof chamber, so that one half of the board can be isolated effectively from the other.

Voltage variation equipment and reactor

The floor under each switch unit is recessed and fitted with a drain connection through which oil discharged in the event of a serious accident is taken from the building to a rubble pit. Vent pipes are provided for each circuit-breaker and connected to bus pipes which discharge outside the building. An automatic fire extinguishing system is being installed.

The rooms are equipped with thermostatically controlled electrical tubular heaters. A small fan, remote controlled, is also fitted in each room for removing fumes and smoke quickly in the event of switchgear accident, thus making it possible for men to enter the room.

The whole of the switchgear contract was executed by Messrs. Ferguson, Pailin, Ltd., who sublet the order for reactors and voltage regulating equipment to the Metropolitan-Vickers Electrical Co., Ltd. All main cablework was done by the Corporation staff. The six boilers were supplied by Messrs. John Thompson Water Tube Boilers, Ltd., the turbo-alternator by the Metropolitan-Vickers Electrical Co., Ltd., and the cooling towers by Messrs. F. Mitchell & Son and the Davenport Engineering Co., Ltd.

Turbine Back Pressure.

By G. W. Maxfield, A.M.I.E.E.

A method of determining the optimum value

IN the operation of turbine plant losses may be caused by excessive pumping as well as by increased steam consumption due to poor vacuum. The problem of deciding precisely what is the point of change from one condition to the other presents so many variables as to drive operators to rely upon sheer guesswork. The losses do not appear on any balance sheets and are quite unaccounted for. Nevertheless, a 10,000-kW set with a life of fifteen years' running at an average load factor of 75 per cent. and with a reasonable outage for overhaul incurs a loss (capitalised) of £4,000 approximately if run habitually off optimum back pressure by only one-tenth of an inch of mercury.

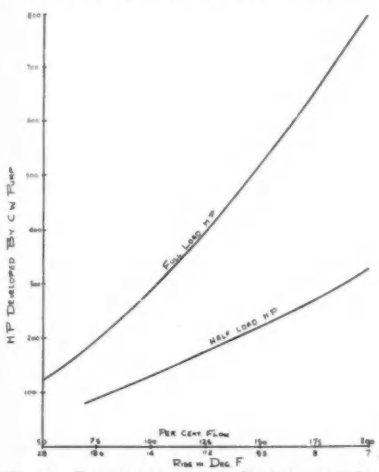


Fig. 1.—Pump energy required for regulation of "rise"

The accompanying three charts, though apparently laborious to draw up, will immediately yield an ample return for the work involved in preparing them. The first two, together with the table, are the means of arriving at the third, the one to which the charge engineer would most frequently refer.

Data Required

It is assumed that the following data is either already available or is easily acquired by test or calculation: (1) Turbo steam-consumption vacuum-correction curves; (2) energy taken by pumps at various rates of pumping; and (3) incremental heat rate for station (overall).

Chart 1 is the first to be drawn up. The data for this must be obtained when the plant is known to be in first-class condition. With the turbine carrying full load the pumps are set to give an arbitrary rise of temperature between inlet and outlet of condenser (say, 14 deg. F.) and the pump load noted. Note also the loss of head* due to friction in the condenser.

Consider this condition as 100 per cent. flow. Now take readings at 50, 75, 125 and 150 per cent., and up to double flow if extra pumps can be brought into commission. The 50 per cent. reading should obviously be done when the turbine is off load, using the method referred to in the footnote. All other conditions are tolerable at full load for tests of short duration. The tests should be repeated with half- and three-quarter load on the turbine, starting as before with a 14-deg. rise. This supplies all the information required for chart 1 and the table, provided that other incidental observations are made during the tests.

BACK PRESSURE REGULATION

Load.	Inlet Temperature of Circulating Water.				
	70°	71°	72°	73°	74°
	in.	in.	in.	in.	in.
½ Load ...	1.53	1.57	1.61	1.65	1.70
¾ Load ...	1.55	1.58	1.62	1.66	1.71
Full ...	1.57	1.60	1.64	1.68	1.73

A portion of chart 2 is now made by transposition from 1 and the table. Curve A shows how the back pressure varies with various quantities of circulating water for a set load (14-deg. rise representing "unit" water in all cases). It should be noted that the back pressure referred to here is essentially that recorded at the exhaust flange. Curves B and C are now plotted against back pressure instead of against flow as in the previous case.

The right-hand ordinates are now scaled off to translate the h.p. or kW of the left-hand ordinates directly into B.th.u., bearing in mind that pump kW is assessed at B.th.u. per kW equal to the *incremental* heat rate of the station. This right-hand scale now enables one to plot the gradient of economy from the turbo steam-consumption vacuum-correction curves. If this information is supplied in terms of water rate an adjustment must first be made for change in temperature of condensate before plotting. This may be obtained from low-pressure steam tables.

It is necessary also to assess the correction for the water rate at the incremental heat rate of the boiler plant, *i.e.*, rate of increase of expenditure of heat with respect to increase of evaporation. This is necessary because an economy at the turbine saves not merely the heat content of the steam saved, but all the heat which would have had to be expended to produce that steam.

Each pair of curves can now be compared. The point on the back-pressure scale where the gradients of the pump-load curve and the heat-economy line are equal (*i.e.*, the point of parallelism) gives the lowest back pressure at which it is economical to run even if a lower pressure can be attained. Presented in its most directly useful form, the same information is to be found on chart 3, together with correction lines for inlet temperature (datum 70 deg.) In practice this enables one to take into account that when pumping is speeded up the inlet temperature rises as the duty on the cooling towers increases.

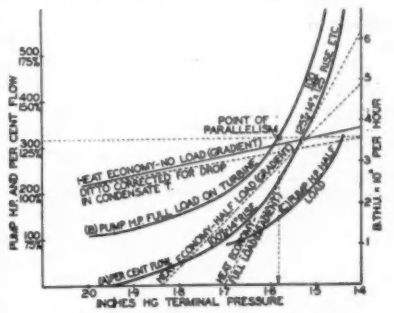

Pump H.P. and Per Cent. Flow
B.Th.U. - 10⁶ per Hour
Point of Parallelism
Heat Economy-No Load (Gradient)
Inches Hg Terminal Pressure

Fig. 2.—Comparison of rate of charge of pump energy and rate of economy in steam consumption

The last-mentioned curves are obtained from the differences of gradients at points on the pairs of curves in chart 2. The correction lines are read thus: Tracing upwards from intersection with zero loss to the intersection with inlet datum, trace horizontally to actual inlet temperature, then vertically to back-pressure scale. In other words, this process means, since the optimum back pressure at full load with 70 deg. water is 1.58 in. Hg., then, if the inlet should rise to 73 deg. the back pressure to which one should regulate is 1.70 in. Hg.

It may be contended that in the table items 1 and 4 cannot be reconciled because "the rate of heat transmission varies as the square root of the water velocity" and not directly. This, however, makes no difference to the validity of the method, because in this study five-fourths flow is defined as that flow which gives four-fifths rise at the same load, three-fourths flow, four-thirds rise, and so on, thus causing the discrepancy to be neutralised in the pump energy observations.

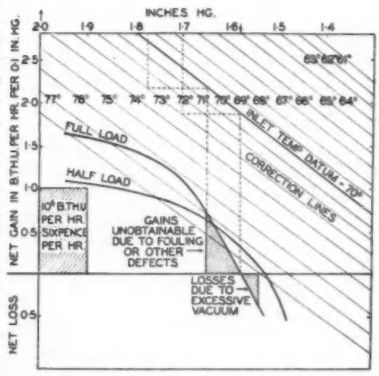

Inches Hg.
Net Gain in B.Th.U. per Hr. per 01 in. Hg.
Full Load
Half Load
Inlet Temp. Datum - 70°
Correction Lines
10⁶ B.Th.U. per Hr. Sixpence per Hr.
Gains Unobtainable due to Fouling or other Defects
Losses due to Excessive Vacuum
Net Loss

Fig. 3.—Curves showing gain or loss per hour (the common back pressure scale matches with that of fig. 2)

Recent researches have shown that, contrary to former belief, the heat transmission coefficient computed from arithmetic mean difference is more reliable than when taken from logarithmic mean difference; consequently, the arithmetic mean temperature has been used for the relationships in the table.

Tabulating the Results

The final curves indicate only what one should expect of the plant when it is known to be in first-class condition (*i.e.*, in the condition it was when the test observations were made). The conclusions should be recorded in tabular form, as shown below, for the guidance of drivers and attendants.

Then the interpretation of the curves for any future defective

*In this study temperature rises are used, but it is sometimes more convenient to interpret loss of head across the condenser in terms of flow.

The Sale Undertaking Case

By J. W. Thomas, LL.B., B.Sc., A.M.I.E.E., Barrister-at-Law

THE recent decision in the House of Lords in connection with the purchase of part of the system of the Altrincham Electric Supply Co., Ltd., by the Sale Urban District Council, brought to an end a dispute which had extended over a period of three years. The case was not important from the standpoint of having settled an important principle of law, its interest lay rather in the fact that it demonstrated how ambiguous terms in an Electricity Order can lead to expensive litigation and illustrated the principles which should be applied when seeking to interpret them.

The point at issue was comparatively a simple one. It turned upon the construction to be put upon the words "total expenditure upon the undertaking" contained in an Electricity Order of 1896, which stipulated the amount which the Sale Council had to pay to the Altrincham Company for the purchase of a portion of the company's system within the district of Ashton-on-Mersey, which is now within the Sale boundary. Under the Order, the company had been given power to supply electricity within the Ashton and the Bucklow Districts, and there was a provision in the Order empowering the Ashton and Bucklow Councils to purchase the electricity systems within their respective areas.

Whole or Part?

In 1932 the Sale Council, with whom Ashton had just been amalgamated, gave notice to the company of its intention to purchase so much of the company's undertaking as was situated in the Ashton area, and it obtained the necessary consent from the Electricity Commissioners. The purchase price, according to the Order, was to be ascertained as follows: "If the accumulated profits of the undertaker shall amount to or exceed 7½ per cent. per annum on the total expenditure upon the undertaking, including the cost of additions and alterations, the purchase money shall be the sum equal to such total expenditure." The question in dispute was whether the total expenditure on the undertaking meant total expenditure on the whole of the undertaking covered by the Order, including the Bucklow district and the Ashton district, or the total expenditure on the Ashton system only, which was the portion actually being acquired by the Sale Council.

The company contended that it was the former, the amount being £109,000, whereas Sale contended it was the latter, the figure for which was £55,000. The parties being unable to agree, the matter was referred to an arbitrator who upheld the view of the company but stated a case for the Divisional Court. It came before Mr. Justice Farwell, who upheld the arbitrator's award. The Sale Council appealed and the Court of Appeal by a majority of two to one reversed the decision of the Divisional Court, whereupon the company appealed to the House of Lords who, by a majority of three to two, gave a decision in favour of the company.

For the company it was argued that the term "undertaking" was intended to cover the whole undertaking and not a part of it and that the words in the Order must be given their ordinary and literal meaning. It was argued for the Council that the term "undertaking" was used in two senses in the Order, sometimes to mean the whole undertaking and sometimes to mean part of it, and one had therefore to look at the results of accepting one meaning or the other before deciding which was the correct one. To interpret the term as covering the whole undertaking when only the Ashton portion was. in fact, being acquired led to a result that was so extravagant and absurd that such a construction ought to be rejected.

In each of the courts the principles of law governing the interpretation of an Act or Order were clearly laid down. Mr. Justice Farwell, in the Divisional Court, said that the function of the court was to ascertain the true meaning of the language used, and for that purpose one must read the document as a whole and give to the words used their proper and primary meaning. If the meaning was intelligible and unambiguous the court was not concerned with the effects. If, on the other hand, the result was that the meaning was not clear, then the court might have to inquire as to the effects of the possible constructions for the purpose of seeing, as far as it was possible, the intentions of the parties from the language which they had used.

Similarly in the Court of Appeal it was laid down that in the construction of statutes they must be construed according to the plain literal and grammatical meaning of the words in which they are expressed, unless that construction leads to a plain and clear contradiction of the apparent purpose of the Act or to some palpable and evident absurdity, in which case the language may be varied or modified.

It was in the application of these well-known principles of law that the difficulty arose. Some of the judges, including Mr. Justice Farwell, took the view that the words in the Order were clear and capable of only one meaning, namely, that the term "undertaking" referred to the whole of the undertaking, and that this interpretation should be accepted notwithstanding that it might appear to work hardship on one of the parties or that the other was getting a good bargain. Other judges differed and expressed the opinion that the wording was not free from ambiguity and that therefore the results of the two possible interpretations must be looked at.

Possible Double Payment

The view advanced by the company that the term "undertaking" referred to the whole undertaking meant that the Sale Council, although actually acquiring a portion of the undertaking only, would have to pay the total expenditure on the whole of it and also the interest thereon. Not only that, however, but if the Bucklow Council in the future served a notice requiring the company to sell it that part of the undertaking within its area it would have to pay as purchase price the capital expenditure on the whole undertaking as well as the interest on it. Thus the company would receive twice over the capital expenditure on the undertaking as well as the interest thereon. This was such an extravagant result that the legislature when framing the Order could not possibly have intended such an interpretation to be put upon it.

Mr. Justice Maugham pointed out further that the two local authorities, Bucklow and Sale, might have given notice to purchase at the same time and two arbitrators might have been appointed to sit on the same day in the same building and might have required, if the company's contention was sound, both authorities to pay the same sum covering the capital expenditure on the whole undertaking, although both authorities would only be acquiring a portion of it, and, in fact, one authority might have been getting much more valuable plant and mains than the other. That, again, seemed to him a palpable absurdity.

Although this latter view prevailed in the Court of Appeal, it was only upheld by two judges in the House of Lords, the other three preferring to accept what they thought was the literal interpretation. Their view was expressed by Lord MacMillan, who said that the words of the Order were as plain as words could be. It was no doubt, he said, a remarkable stipulation that the price to be paid for the purchase of a part of an undertaking should be measured by the expenditure of the undertakers on the whole of that undertaking, but in his opinion a court of law had no power to reform a bargain because it was found to have unreasonable consequences. In the present case the words used were not ambiguous or, in his view, susceptible of two meanings, and it must be assumed that the legislature meant what it said.

To the layman it may be a matter of surprise and regret that there should have been such division of opinion amongst high legal authorities, but the real criticism, if any, should be directed, not at the judges who endeavoured to apply well-established canons of construction, but to the drafters of the Order who did not employ language free from ambiguity.

Turbine Back Pressure (*Continued from preceding page*)

RELATIONSHIP BETWEEN VACUUM, TEMPERATURE AND FLOW.
(Inlet Temperature 70 deg. F.).

Flow per cent.	Mean temperature.	Outlet temperature.	Outlet minus inlet temperature.	Exhaust temperature.	Vacuum when clean.
200	73.5	77.0	7.0	90.5	1.44
175	74.0	78.0	8.0	91.0	1.46
150	74.6	79.3	9.3	91.6	1.50
125	75.6	81.2	11.2	92.6	1.54
100	77.0	84.0	14.0	94.0	1.60
75	79.3	88.6	18.6	96.3	1.70
50	84.0	98.0	28.0	101.0	1.96

Vacuum in inches Hg; Temperatures in deg. F.

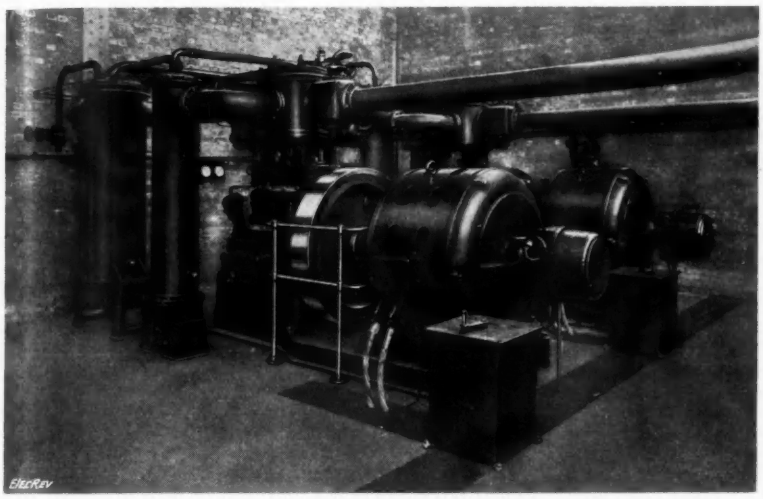
performance is as follows: 73 deg. water using a known quantity of energy at the pump should give 1.70 in. Hg.

Actually, it is giving 1.775 in. Hg, and, tracing this backwards in chart 3, the cross-hatched portion is a measure of the loss per hour incurred by the defect, whatever it may be (fouling, leakage, faulty air extraction, &c.). From this information it may then be decided whether to tolerate or take steps to rectify it. In any case, the loss in the aggregate can be balanced against the cost of cleaning or against the cost of the extra pumping required to re-establish the expected back pressure by forcing.

Power Plant Manufacture

A visit to a Hertfordshire works

THE company of Messrs. J. Browett Lindley (1931), Ltd., had its beginnings as far back as 1878, when the two founders commenced to build vertical high-speed steam engines in works near Manchester. With the development of the electrical industry, and the consequent demand for engines of this type, the firm grew rapidly and in the course of time turned its attention to other types of plant. It was one of the first to produce a range of vertical high-speed gas engines; then compressors, condensing plant and oil engines claimed a share of attention.



Two 750 cu. ft. p.m. motor-driven air compressors recently installed at the Tir John power station, Swansea

Some years ago the business was transferred to its present site at Letchworth, Herts, and, in addition to a very complete equipment of machine tools, the present works possess the advantage of iron and steel foundries capable of dealing with large castings.

Apart from enabling us to see activity on contracts under construction, a recent visit afforded us an opportunity of inspecting extensions and improvements that have been carried out to cope with increased output. In the machine and erection shops new bays have recently been added, giving a considerably increased productive area. Three additional cranes have also been brought into use here (the largest having a capacity of 15 tons) and a number of new machine tools have been added, besides a new Vickers-Spearing boiler plant which has been installed for testing steam engines. This has a capacity of 30,000 lb. of saturated, or super-heated, steam per hour at 250 lb. pressure, and is equipped with an Illinois chain grate stoker. The test bed has also been enlarged and the necessary electrical and hydraulic equipment brought up to date. Additions have also taken place in the foundry and elsewhere.

Compressors Under Construction

At the time of our visit, among a number of interesting units in the course of construction, were two very compact tandem two-stage steam-driven air compressors for a mine in Western Australia each of 500 cu. ft. per minute capacity. The motor driven type of compressor was represented by examples of 700 and 1,000 cu. ft. capacity and we understand that soon after our visit work was commenced on two further motor-driven compressors for the Fulham power station. These are designed for a pressure of 300 lb. per sq. in. (rather higher than the normal for industrial service) and have a capacity of 562 cu. ft. per minute. Another large compressor in course of construction was arranged for direct drive by a 340/370-b.h.p. 330-r.p.m. gas engine. Unlike the machines mentioned above, this compressor is of the single-stage type, having a capacity of 3,300 cu. ft. per minute. We were told that it is for a large gas works in Japan, the engine being a duplicate of one previously supplied.

A number of steam-driven generating sets in the shops had outputs ranging from 100 to 250 b.h.p. Though some were being supplied with condensing plant, the majority were designed to work against a back pressure, supplying steam for various process work.

The advantages of this type of power plant, where a boiler plant already exists, are now becoming better known, and in most cases it is claimed that the back pressure or extraction engine can compete very favourably with oil engines, gas engines, or public supply.

A 200-kW generating set we saw on test is now being erected at a South Coast creamery where it will displace two oil engines as the source of power. With the old arrangement the process steam (for "Lurgi," condensing, "Montana" and other drying and heating installations) was taken direct from the boiler through reducing valves at the various points. Under the new scheme the steam set will supply the total power requirements, the process steam being taken from the exhaust of the engine.

Any extra heating steam which may be required from time to time will be taken from the boiler through an "Arca" by-pass valve. An ejector condenser will also be supplied for use during certain periods when no process steam is required. It should be noted that by the use of special bronze restrained-type rings, the engine can operate without cylinder lubrication, thus ensuring that the exhaust steam is not contaminated by oil.

Engineers who are called upon to advise on the installation of combined heating and process plants will find that the accompanying curves prepared by Messrs. Browett Lindley, enable an approximate estimate of the savings to be readily calculated from a knowledge of the steam consumption and conditions. They also show the corresponding output of power in kilowatts.

The curved lines in fig. 1 represent various values of back-pressures, while the lower right-hand portion gives the corresponding output in kilowatts when read in conjunction with the steam consumption. Taking an example where the boiler pressure and back pressure are respectively 125 and 25 lb. (gauge) and the process steam consumption is 8,800 lb. per hour, the possible output of 155 kW is easily found by reading along the 125 lb. pressure line and thence downwards until the horizontal line for 8,800 lb. is reached (see dotted lines). If the percentage steam consumption at any fractional load be required, it can be obtained from the left-hand curve for 25 lb. back pressure.

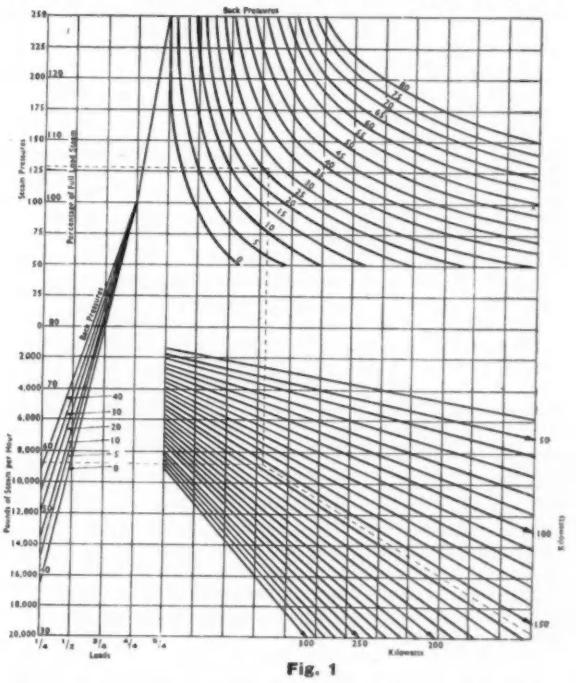


Fig. 1

Calculating Fuel Costs

The cost of fuel (per hour and per year) is plotted against steam consumption in fig. 2, which also indicates the corresponding cost of electricity at various standard rates. In preparing the curves it has been assumed that the calorific value of the coal is 12,500 B.th.u. per lb.; cost of coal 25s. per ton; boiler efficiency 68 per cent.; banking losses, &c., 15

per cent. Assuming that the demand for process steam is equal to that required for the engine, and taking the same example as before, the annual fuel cost for 8,800 lb. per hour is found to be £1,750 when the process steam is taken direct

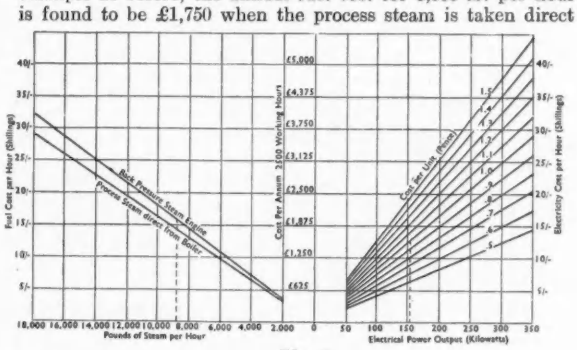
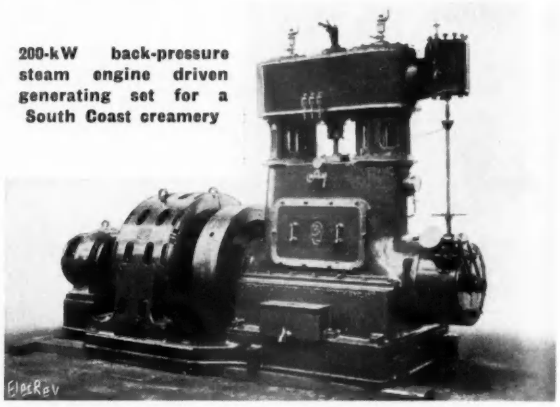

Fuel Cost per Hour (Shillings)
Back Pressure Steam Engine
Process Steam direct from Boiler
Cost Per Annum 7,000 Working Hours
Cost per Unit (Pence)
Electricity Cost per Hour (Shillings)
Pounds of Steam per Hour
Electrical Power Output (Kilowatts)

Fig. 2

from the boiler. If the same amount of steam be first passed through the engine, a slightly higher fuel cost of £1,970 per annum would be required.

Taking the right-hand curves and assuming an average figure for purchased electricity of 1d. per kWh, the cost of power would be £1,560 per year (2,500 working hours) for a 155 kW working load. Hence the saving would be £1,750+£1,560−£1,970=£1,340 per annum. From this figure must be subtracted the interest and depreciation, upkeep and labour charges, which are, however, in most cases small items compared with the savings which result from the use of a combined heating and power scheme.

The curves can, of course, be adapted to do duty for fuels of different values or for working periods other than 2,500 hours per annum, but it should be noted that the above example only applies to the most efficient cases, *i.e.*, where the demand for process steam is equal to that required for the engine. For other conditions, or where superheated steam is employed, reference should be made to the manufacturers for guidance.



200-kW back-pressure steam engine driven generating set for a South Coast creamery

Electrical Uses of Nickel

An expanding market; recent developments

A SURVEY of the nickel industry in 1935, based on the records of the International Nickel Co. of Canada, Ltd., and the Mond Nickel Co., Ltd., reveals that production facilities are being increased to meet the demands for this metal, which have grown steadily during the last three years. World consumption during the first ten months of 1935 totalled 133,300,000 lb., an increase of 20,818,400 lb. on the equivalent period of the previous peak year (1929). There are now more than 1,000 trade-marked alloys containing nickel.

This basic material has been among the first commodities to feel the impulse of returning industrial activity. There is a significant trend towards the use of better grade materials for replacement purposes, nickel alloys now being frequently specified where simple metals were previously customary.

Considerable work has been done to improve the quality of the rolled anode, and it may now be considered the most uniform and highest quality nickel anode on the market. This recent work has both improved the solubility of the anode and decreased the possibility of "rough work," a feature of special interest to the plater.

Nickel-steel welding rods have been developed for welding high strength steel plates, while monel metal electric welding rod is now coated in a special extrusion machine and "K" monel has been electrically welded with excellent results through the use of a flux coated electrode. Continued improvement in flux coatings on all electric welding rod is giving better welding characteristics as well as physical properties. Nickel steel forgings have been ordered for steam power and electrical plant in the U.S.A., while nickel alloy steels are being increasingly used in the manufacture of tools.

Application to Electric Cookers

Several manufacturers of electric ranges (cookers) are employing monel metal tops for their standard models, and an outstanding application is to rustless tanks for hot-water storage heaters, including electric heaters. Plant has been established at Port Colborne, Ont., to produce these tanks for the Canadian market.

The use of "Inconel" as the sheathing material for enclosed electric range heater units found further favour; as the result of tests one manufacturer is able to guarantee his range units for a period of ten years. This is of particular interest to public utilities because element replacement is not only expensive but is a factor in reducing their load.

Production of electrical resistance wires containing high proportions of nickel (60-80 per cent.) increased during the year. Typical uses range from large industrial electric furnaces to such small household appliances as toasters, electric irons and heaters. The advantages of this high nickel-chromium alloy include strength at high temperatures, low scaling loss and uniformity of temperature throughout individual pieces of equipment, as well as ease of lubrication.

The radio industry continues as a large market for rolled nickel, and development of the all-steel radio valve is causing further expansion. Production during 1935 of vacuum tubes of both the glass and the all-metal types is estimated at 54,000,000, and in the case of the all-metal type nickel alloy is used for the lead-wires.

The permanent magnetic alloys recently developed provide a new use for nickel in radio microphones and loudspeakers, and also in small d.c. motors, magnetos and measuring instruments. A typical composition contains 20 per cent. nickel, 12 per cent. aluminium and 3-5 per cent. cobalt.

Advances in the field of bimetallic strip for thermo-elastic elements resulted in the almost universal adoption of alloys with appreciable nickel content for the high expansion element. Alloys of the "Invar" type containing either 36 or 42 per cent. nickel have long been standard for the low expansion side.

New Alloys

Three new high nickel alloys designed for sealing into both hard and soft glasses appeared on the market. All contain about 30 per cent. nickel. They match closely the expansion curves of all known glasses which exhibit a "kick," or bend, just below the softening temperature. This permits a vacuum-tight and practically stress free joint between glass and the alloy. In addition to making the small all-metal valve possible, these alloys have a field of usefulness in the construction of mercury arc rectifiers and similar applications.

"Iso-elastic" alloy, the metal of constant elasticity, which was originally developed as a material for springs in weighing machines, has branched into other fields, including vibrating reeds to replace the quartz crystals used to keep radio stations accurately on their wavelengths. Tests are now being conducted with monel metal envelopes for valves.

Forty per cent. of the buses in Paris are equipped with nickel-cadmium batteries, as are practically all the electrically driven trucks. These batteries are also used on all French diesel-electric locomotives.

Consumption of nickel in the form of anodes for electro-deposition increased substantially. There was a definite increase in the number of manufacturers, particularly in the transport industry, specifying a nickel undercoating of 0.001 in. in thickness as standard for chromium plating.

Development of bright nickel plating, which reduces the buffing ordinarily required in plating jobs and which speeds up the rate of electro-deposition, continued among the larger operators. As this method is further improved with a consequent reduction in costs, its use is likely to become more general.

Progress continued in the development of welding of nickel and nickel alloys and in their application in welded structures. Improvements were made in welding technique and in the coated weld rods available. Requirements have become more rigorous with respect to items of design and the perfection of materials and technique.

Oil-Electric Locomotives

A demonstration at Preston of railway shunting operations

ONE is apt to regard diesel-electric locomotives as being built in ones and twos. But last week's visit to the former Dick Kerr traction works at Preston, together with a demonstration of shunting operations in the adjacent railway goods yards, served as reminders of the contribution which the English Electric Co., Ltd., has made to the development of the internal combustion engined vehicle.

During the war period the company built a number of 40-h.p. petrol-electric locomotives at Preston, and subsequently supplied 100-h.p. petrol-electric rail car equipments to the Uruguay State Railways; a 50-ton, 100-h.p. petrol-electric breakdown locomotive to the Montreal Harbour Commissioners; electrical equipments for 200-h.p. diesel-electric railcars on the San Sebastian-Pamplona Railway, Spain; and complete 200-h.p. diesel-electric coaches to the Venezuela Central Railway. Further, in conjunction with Messrs. Armstrong-Whitworth & Co., Ltd., it provided the electric control and motor equipments for the three diesel-electric "mobile power house engined trains" and the diesel-electric locomotive which were put into service in 1933 on the Buenos Aires Great Southern Railway. As examples of vehicles fitted with mechanical transmission reference can be made to the 100-h.p. petrol engined motor coaches and the 300-h.p. petrol engined locomotives supplied through the Drewry Car Co., Ltd., to the Bermuda Railway.

In 1933 the company built a complete 200-h.p. diesel-electric rail coach (entirely at its own works) fitted with a high-speed 200-h.p., 1,500-r.p.m. engine, which the London, Midland and Scottish Railway has tested in service for about eighteen months. At the same time, in conjunction with R. W. Hawthorn Leslie & Co., Ltd., who made the mechanical parts, a 300/350-h.p. diesel-electric shunting locomotive was constructed, which has completed over twelve months' service on the L.M.S. railway, working on a 24-hour basis, and the engine has run over 5,000 hours. As a result of the successful operation of this locomotive an order for ten more was received from the L.M. & S. Railway, while orders have been received for a

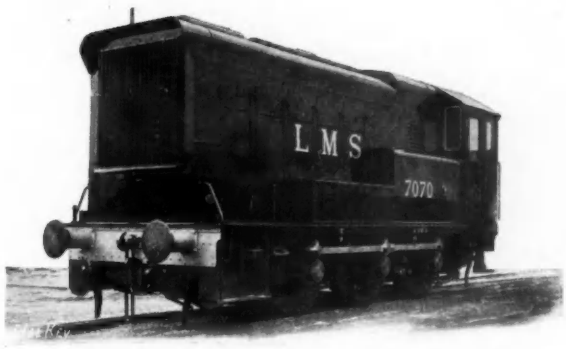
Driver's cab with dual control (breakfast type cooker in background)

similar locomotive from the Great Western Railway, and for two (for 3 ft. 6 in. gauge) to operate under arduous conditions on the Sudan Government Railways.

In addition, three similar locomotives are also being completed for the New Consolidated Goldfields, South Africa. In this instance 7-cylinder engines are being used, having a normal output of 410 b.h.p. at sea level and 350 b.h.p. at the site, which is 5,750 ft. above sea level, the extra cylinder being necessitated by the altitude.

To exclude sand and grit from their working parts, the Sudan locomotives have air filters for the ventilation of the motors and engine compartment. All nuts and bolts on the machinery are specially rust-proofed to withstand tropical conditions.

In addition to the diesel-electric locomotives described above, of which five are already in operation on the L.M.S. Railway,



An English Electric diesel-electric shunting locomotive

a number of smaller mechanical drive locomotives are also under construction at the Preston works, including six 75-h.p. petrol-mechanical types for the New Zealand Government Railways, and three 75-h.p. and two 50-h.p. diesel-mechanical locomotives for the Eagle Oil Co. These small models are built by the E.E. Co. in conjunction with the Drewry Car Co., Ltd.

Tramcar chassis with centre-drop frames are also being built at Preston as well as luxury road coach bodies, which are fabricated with the aid of electric welding out of angle steel frames with aluminium panels.

The 47-ton 350-h.p. shunting locomotives are driven by single 6-cylinder medium-speed diesel engine which are totally enclosed and have automatic lubrication, failure of which will automatically stop the engine. The d.c. 270-kW (at 540 V and 695 r.p.m.) generator is directly coupled to the engine, and three-point suspension with one trunnion bearing at the forward engine end and two at the generator (cab) end relieves the crankshaft of undue strain. All pumps are attached to the engine casing, so that the whole can be lifted out as a unit.

The forward radiator is a dual cooler for water and lubricating oil, having an electrically driven fan under thermostatic control. The engine is started by electrically motoring the generator with the aid of an 80-V lead-acid "D.P." battery.

Driving Features

The transmission system is all-electric and incorporates the "E.E." patented torque control method which makes it impossible in any circumstances to overload the diesel engine. Series-parallel control is used for the driving motors, which are mounted on the axles and drive through single-reduction spur gearing. The three axles (six wheels) are in turn coupled together by side rods.

Nine driving notches are provided and in the cab there are dual controllers, one on each side. A "dead man's" device is operated by means of a foot pedal and a time-delay action is incorporated to enable the driver to move over from one side of the cab to the other without shutting off power.

A straight air brake or vacuum brake is fitted, as desired. The associated compressor or vacuum pump is driven by an independent motor, for which an alternative supply is available from the battery. This also energises the small breakfast type electric cooker which is fitted in the cab for heating the driver's meals. The cab is heated by circulating hot water under the driver's control.

Traction equipment made by the company is in operation on fifty-nine railways in nineteen countries. It has made diesel engines at its Willans works at Rugby for many years and prefers electrical coupling for transmitting 200 h.p. and over.

Diesel-electric shunting locomotives are capable of operating for 23½ hours per day for 6½ days per week, so that in a busy goods yard it is considered that twelve such locomotives could replace nineteen steam engines. Fuel and lubrication costs for shunting locomotives of the size described above average 1s. per hour (half those of a steam engine) and not more than 2 gallons of cooling water is used per 24 hours. Other assets are absence of stand-by losses and ease of operation. On a 7-day week and 24-hour basis half a day suffices for routine inspection and cleaning.

The application of power to the driving wheels by rotary motion is said to enable a diesel-electric locomotive to transmit an effective tractive effort from 10 to 15 per cent. greater than that of a steam engine of equal weight. The mechanical superstructure, frame, axles and wheels are manufactured according to British Standard Specifications. Power response and reversal are immediate, the control levers being similar to those of a steam engine.

Accessibility is another feature. The complete engine-generator set can be lifted out through the detachable roof and the main generator armature may be drawn out through the driving cab without disturbing other main items, all of which are similarly removable.

Meetings and Discussions

Experience With Discharge Lamps
Russian Industrial Evolution
Fluorescence and Phosphorescence

Mercury-vapour Street Lamps

THE high-pressure mercury-vapour lamp used in public lighting was the subject of the paper by Messrs. G. H. WILSON, E. L. DAMANT, and J. M. WALDRAM (of the G.E.C. Research Laboratories, Wembley) which was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 5th. Experience gained with this type of lamp during three years is recorded in the paper, which also deals with engineering and photometric characteristics and the design of the auxiliary apparatus, together with certain peculiarities of street-lighting circuits which affect its performance.

An optimum installation for a main traffic route with a moderate volume of traffic moving at 30 m.p.h. or more, with average road surface characteristics, is specified by the authors as follows: The mounting height of the lamps to be about 25 ft. with posts normally staggered, but varied where necessary for curves and crossings. The "five degree rule" must be adhered to as far as possible; that is, the sources should be so arranged that from any driving position any sources more than 200 ft. distant and adjacent in perspective do not subtend at the eye an angle on plan greater than about 5 deg. When funds permit much better results can be obtained if the staggered system is doubled to form an opposite system.

The width between rows of sources should not exceed 30 ft. For carriage-ways not exceeding 30 ft. in width and for sources 25 ft. high, overhang from the kerb is unnecessary and in some ways undesirable. Where the width exceeds 30 ft. an overhang up to but not exceeding 6 ft. is beneficial. For good results, roads more than 45 ft. wide require three rows of sources.

On straight roads the average spacing of sources in one row should not exceed 300 ft., and should preferably be less. On bends, &c., it may be desirable to transfer the sources all to the outside of the bend, in order to satisfy the "5 deg. rule," and the spacing may well be reduced to 100 ft. or even less on sharp bends. The maximum spacing between any individual pair of sources in one row should not exceed 350 ft.

Regarding light distribution the ratio of the maximum intensity to that in the region of the downward vertical should not exceed about 6, in order to avoid glare. The maximum intensity in candles, as a rough and ready rule, should not be in excess of one-half of the numerical value of the flux emitted by the bare lamp in lumens, in order to avoid glare. The distribution between the downward vertical and the maximum should give a flat-bottomed polar curve, *i.e.*, should follow approximately the law $I_\theta = I_o \sec\theta$, to prevent apparent "shadows" near the post.

The region of maximum intensity should extend from about 77½ deg. to 87½ deg., above which angle it should diminish as rapidly as practicable. This gives long, wide, bright areas and avoids waste of flux. Adequate light should be provided upon the buildings, fences, &c., adjacent to the highway. In plan, the region of maximum intensity should include the direction parallel to the street axis and extend for at least 5 deg. on the house side and 15 deg. on the street side, in non-axial equipment; and for 10 deg. on either side of the street axis in axial equipment

A light output of at least 3,000 lumens per 100 ft. run, and preferably twice this value, should be provided in each row of sources. This is obtainable by using 250 W, or preferably 400 W, h.p. m.v. lamps at 300 ft. spacing in each row. The cost of an installation of this kind will vary considerably with local circumstances, but an approximate annual figure, including capital charges, appears to be £350 to £450 per mile.

Since this paper was drafted an interim report has been published by the Ministry of Transport's departmental committee on street lighting in which somewhat similar recommendations are made.

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Oil-engine Working Costs

THE report on heavy-oil engine working costs which is prepared each year by the DIESEL ENGINE USERS' ASSOCIATION was discussed at a meeting of the Association in London on February 28th. It shows that during 1934-35 there was a further reduction in the output of public electricity supply stations; in fact, many of those stations which used to form the backbone of the reports did not operate, or ran only a hundred hours or so for peak load or stand-by purposes. While the manufacturers of oil engines have found that the demand from private users has more than made up for the lack of orders from public supply undertakings, a smaller proportion of the former are able to send in their costs figures for publication.

So many of the home stations show very low load factors that their inclusion in any average result would give an entirely wrong impression of the working cost of a normal diesel station; no average cost per kWh generated has, therefore, been given this year, although fuel and lubricating oil consumptions have been averaged, as well as load factors.

In the home market, 300-, 225- and 500-b.h.p. (new) engines were installed, while 300-, 650-, and 1,470-b.h.p. (new) engines were added to overseas stations. Five out of the six were of the airless-injection type, contrary to the previous year's indication of a preference for the air-injection type.

Of the overseas stations recorded, the large plant at Broken Hill operated at a total cost of 0.297d. per kWh generated over a period of three full years. Of this cost 0.239d. represented fuel, 0.007d. lubrication, 0.003d. stores and water, 0.023d. wages, and 0.025d. repairs and maintenance. The energy generated in the three years totalled 131,833,464 kWh. The average annual load factor was 32.8 per cent. and the lubricating oil consumption averaged 7,330 rated b.h.p.-hours per gallon.

Out of fifty-two stations, twenty-eight returned fuel consumptions three per cent. below the standard. The average was 0.637 lb. per kWh generated, the average load factor being 68.8 per cent. By omitting one station the average lubricating oil consumption of 2,250 b.h.p.-hours per gallon can be made to show an improvement over the previous year.

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Engineering Progress in Russia

MR. ALLAN MONKHOUSE, of the Metropolitan-Vickers Research Department, lectured on "Engineering Conditions in Russia" at a meeting held in Glasgow last week under the auspices of the INSTITUTION OF PRODUCTION ENGINEERS (Glasgow Section). Mr. T. White, president of the local section of the Institution, took the chair, and several members of the Scottish Centre of the Institution of Electrical Engineers were present. Mr. Monkhouse said that in the course of their progress the Russians had introduced tremendous changes in their original ideas about organisation and methods of payment. Under the new regime the lot of the seven million industrial workers was a little improved, but that of the 120 million peasants was nothing like so happy. Mr. Monkhouse spoke of the early days of power-station construction and showed a number of lantern slides. Training Russian labour was a big difficulty. In the old days only two million people were employed in industry, including railways and textiles, whereas to-day nearly seven million people were employed. Another serious difficulty was instructing technical staffs.

With regard to fuel for power generation the use of peat was one of the most interesting developments. It had about 4 per cent. ash and extraordinarily little slag. In some of their boiler houses they managed to get about 83 per cent. efficiency, which was almost as good as was obtained in this country from coal. Under the Five-Year Plan the load upon power stations had risen 50 per cent., an increase, it was claimed, that was still being maintained.

An interesting function of a huge power station in Moscow was the heating of practically the whole of the centre of the city by water, which left the station at a temperature of 120 deg. C., returning at about 60 deg. This system was so successful that about ten more stations were to be erected so as to heat the whole city in the same way, while similar schemes were being applied in Leningrad and the big new industrial districts. The principle was right, said Mr. Monkhouse, because they were utilising the heat energy of fuel to a much greater extent than we did in the average power station. It was also being followed elsewhere in Europe, and would be adopted in this country as time went on.

Production of such articles as electric kettles, cycle-lighting sets, gramophone motors and electric irons had been rushed

ahead and had increased enormously under the Plan. Electric lamps, too, were being manufactured at the rate of about 68 millions per annum, which about fulfilled their needs, and they were now paying more attention to heavier plant and were building all their own turbo-generators. The number of electric motors turned out in 1934 was 119,000, but the greatest progress had been on the lighter side.

The establishment of a new industrial area in the heart of Asia, where a number of factories had already been built, was putting Russia in a very strong position for exporting to and commanding the markets around her Asiatic frontier. Mongolia obtained from Russia a tremendous amount of her supplies, while Persia purchased a considerable amount of electrical and radio apparatus, Turkey taking other equipment, including boilers. Transport, particularly rail passenger transport, was in an appalling condition, but was improving slowly, while air services were being steadily developed. In industrial research the Russians were working along very sound lines, and spending a great amount of money.

A reason for the rapid industrial progress was that industrial appointments of recent years had been given to men solely for their technical ability, not for political purposes. Factories were now organised and managed in a way that was almost identical with that employed in this country. The old idea of equal pay had completely gone and there was payment by results everywhere.

In every phase of Russia's life to-day they saw the Government changing back again to what we would regard as more reasonable methods. He thought there was no doubt at all that as time went on the Russians would attain to a very much greater degree of success than many people had hitherto anticipated.

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Fluorescent Screens and Oscillographs

TWO papers were presented at the March 4th meeting of the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London. The paper by Dr. L. LEVY and Mr. D. W. WEST is an account of the principal materials used for coating fluorescent screens for cathode-ray tubes for television and other purposes.

The fluorescent and phosphorescent (afterglow or "lag") phenomena displayed by willemite, calcium tungstate and cadmium tungstate, zinc phosphate, and the various preparations of zinc sulphide and zinc-cadmium sulphide, are dealt with in detail. The method whereby the undesirable phosphorescence displayed by zinc sulphide and zinc-cadmium sulphide has been eliminated is explained. Photometric measurements of the illumination of screens composed of a variety of materials under different conditions of excitation are given. A number of spectrograms are included of the fluorescent light emitted by these substances.

The results show that (1) Zinc sulphide and zinc-cadmium sulphide are the most suitable substances hitherto developed for fluorescent screens for cathode-ray tubes. (2) A special zinc sulphide, giving approximately white fluorescence, has been obtained. (3) A mixture of zinc sulphide and zinc-cadmium sulphide, giving a brilliant white fluorescence of high intensity, has been prepared. (4) Phosphorescence, when not required, can be entirely eliminated. (5) Zinc sulphide and zinc-cadmium sulphide giving prolonged phosphorescence can be produced, and these compounds find application for special purposes.

The emission of luminous radiations which ends immediately the stimulus of exciting radiation has ceased to act is known as fluorescence; its wavelength is always greater than that of the exciting radiation. Phosphorescence differs in that it refers to light which continues to be emitted by a luminescent substance after the exciting radiation has ceased to act. The fluorescence of a luminescent body builds up almost instantaneously to a maximum intensity, which remains constant over a considerable period of time so long as the exciting radiation is unaltered. The phosphorescence occurs simultaneously with the fluorescence but, owing to its feebler intensity, it is only perceived when the fluorescence ceases. It is also found that it builds up more slowly than fluorescence during the first period in which the exciting radiation is acting. The intensity of phosphorescence diminishes continuously immediately upon the cessation of the exciting radiation. The rate of fall of luminescence is greatest at the beginning and decreases exponentially with lapse of time.

Fluorescence is the conversion of some form of energy into radiation in the visible spectrum. Phosphorescence is the emission of latent energy in this region. According to some authorities, the distinction between them is not a rigid one. A substance, when fluorescing, can be regarded as being in a meta-stable condition, the luminescence being a phenomenon which is associated with a state of strain into which the molecule has been thrown owing to the incidence of the exciting radiation. The maximum amount of light now obtainable amounts to 4 or 5 per cent. of the energy input. Messrs. A. C. Cossor, Ltd., prepared cathode-ray tubes coated with the various fluorescent preparations and lent apparatus.

The second paper, by Mr. L. S. PIGGOTT, compares and contrasts the performances of gas-focused and electron-lens-focused oscillographs at radio and ultra-high frequencies of deflection.

The superior focusing properties of, and absence of origin distortion in, the electron-lens-focused tube are demonstrated. Characteristics peculiar to either type of tube are discussed, and some phenomena common to both types, when used at very high frequencies, are described. Finally, the author sug-

Last Monday night one of the large step-up transformers was transported from the local railway goods yard to the new Fulham station. Our pictures show the transformer photographed upon its arrival and being taken into the station. Its rating is 75,000 kVA (11/66-kV) and its net weight is 100 tons

gests that when its shortcomings are understood the electron-lens-focused cathode-ray oscillograph should prove itself a most useful instrument at very high frequencies. Its peculiar focusing properties, which ensure a sharp trace at a frequency 1,000 mc/s or more, render possible working at fair precision.

* * *

Rising Mains in Large Buildings

AT a meeting of the London Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION on March 1st Mr. R. N. KEENE read a paper on "Rising Mains in Large Buildings." It was pointed out that owing to the large loading required in modern buildings the use of v.i.r. cables was gradually ceasing because it was necessary to have a number of individual mains to feed, perhaps, only two or three flats, and additional switch or fuse gear had to be provided to control each main. Nevertheless, v.i.r. cable in tube was often very convenient where new mains had to be run in existing buildings.

Armoured cables were, in Mr. Keene's view, the most suitable for rising mains, being obtainable with twin-, three-, or four-core conductors under one sheath. Fibre insulation was now used extensively and, to a lesser degree, cambric insulation. Paper-insulated cables should be suitably drained for vertical use. Alternatively, the "sandwich" type of cable might be employed, the insulation of which was composed of alternate layers of wet and dry paper, any excess of oil being absorbed by the dry layers.

Copper strip for rising mains was becoming increasingly popular, being exceedingly flexible from the load point of view and having a very long life. A suitable chase had to be provided up the buildings and this should be about 2 ft. wide and 9 in. deep.

Mr. Keene said a point of great importance was the grading of fuses or circuit-breakers throughout the installation. Often the supply company had a small sub-station on the premises, probably adjacent to the main switchgear for the building. This meant a very short cable run and the possibility of getting exceedingly large currents on short-circuit, perhaps 6,000 to 10,000 A, owing to the very low impedance of the circuit. Under these conditions, time lag was of first importance. A number of companies were adopting the high-rupturing capacity type of fuse which would disconnect the circuit exceedingly rapidly under extreme short-circuit conditions.

In one block of fifty-seven flats where there was central heating, the installed load was 447 kW and the maximum demand 87 kW. The diversity factor was 19.15 per cent. and the load factor 39.5 per cent. In a block of thirty-seven all-electric flats with central heating and domestic hot water the installed load was 589 kW, the maximum demand 83 kW, the diversity factor 14.15 per cent., and the load factor 31.8 per cent. These figures showed that, even with a large installed load in all-electric flats, there was a big diversity. Urging care in the selection of suitable rising mains for blocks of flats, Mr. Keene said that this must be regarded as the backbone of future increases in the use of electricity in many areas.

In the subsequent discussion Mr. D. A. S. PORTEOUS, the chairman, suggested that possibly the type of cable used in coal mines (*viz.*, multi-core with rubber sheathing, and waterproof, single or double wire armoured) might compete with the paper cable for rising main purposes. Even the paper cable had to be lead covered and was therefore heavy and possibly cumbersome. He also called attention to the manner in which the rubber cable was unfairly handicapped by the I.E.E. Wiring Rules.

Mr. J. W. JEFFREYS, a member of the committee of the Electrical Research Association which supplied the technical information to the Institution of Electrical Engineers in connection with the Regulations, said that the temperatures at which various types of cable were to be run were referred to the Cable Makers' Association to decide. He thought that anything the cable manufacturers could do to increase the permissible loading of cables would willingly be accepted.

The view that rising mains in large buildings should be as much the work of the supply authority as was the laying of mains in the street was expressed by Mr. J. PARR-MORLEY (hon. secretary). The supply authority would then be in the position to make regulations and see that they were carried out. A point lost sight of was that mains in the streets were fed from both ends, whereas rising mains were not, and the top flats might, or might not, get some voltage. He suggested that ring mains should be used for such buildings. "Riserods" were conductors in the form of copper rods running up a building and enclosed in micanite tubes. A recent installation he had seen was one of the best that had come to his notice for a long time. The tubes were in chases and it was possible to deal with this form of conductor in the same way as any other.

Mr. A. DAVIDSON could not see why the supply authority should assume responsibility. Surely it was within the capacity of the consulting engineer correctly to design mains and circuit-breakers by inquiring of the mains engineer what power there was behind the mains. The author agreed, provided the wiring contractors could be got to look at the matter from an intelligent point of view. The difficulty, he said, arose out of the system of competitive tenders.

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Protective Systems

At the informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London on February 24th Mr. T. C. GILBERT opened a discussion on "Multiple Earthing or Leakage Trips," making particular reference to rural areas rather than to urban districts where conditions are much more favourable. He did not concern himself with the difficulties of the supply authorities, but with the protection of the consumer. The multiple earthing system was often impracticable, he said, because of the impossibility of finding favourable conditions for earth electrodes in many rural areas. There was also liability to variable resistance, corrosion and deterioration. Experience had led Continental countries to abandon all attempts to connect consumers' apparatus to the multiple earth line; there had been developed instead inexpensive trip devices of which some examples of British manufacture were exhibited. Mr. Gilbert added that multiple earthing might be said to have failed in parts of New Zealand, and in the U.S.A. and Canada where the ground froze in winter to a depth of several feet, earthing was impossible. He favoured most strongly the use of leakage trip devices on the score of practicability, cost and ease of testing.

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A Welding Conference in Wales

A conference on welding, organised by Prof. F. BACON, took place on March 4th in the Engineering Department of the University College of Swansea, under the chairmanship of Principal C. A. Edwards. Prof. F. C. Lea, of Sheffield University (chairman of the Welding Research Committee of the Institution of Mechanical Engineers) lectured on "Some Researches in Connection with Welding," while a series of lantern slides illustrating the uses of welding in strip mill practice was shown by Mr. J. S. Caswell. Those who were to take part in the discussion included Mr. C. R. Davy, chief research engineer of Babcock & Wilcox, Ltd., Mr. A. Ramsay Moon, and representatives of the Metropolitan-Vickers Electrical Co., Ltd., and the British Oxygen Co., Ltd. Over 350 visitors were expected to attend from works all over South Wales and Monmouthshire, and it became necessary to supplement the programme with an extra "informal discussion for practical welders" under the chairmanship of Mr. W. C. Mitchell, general manager of the National Oil Refineries, Ltd., in order to relieve the congestion that would otherwise have occurred at the exhibition, which was arranged to illustrate technique and testing methods. The joint exhibit of the British Mannesmann Tube Co., Ltd., and the "Unit" Superheater & Pipe Co., Ltd., illustrated their recent welding experiments preparatory to the British construction of the Loeffler boiler. Other exhibitors included: British Engine, Boiler & Electrical Insurance Co., Sir W. G. Armstrong Whitworth & Co., Ltd., Babcock & Wilcox, Ltd., Braithwaite Welding & Construction Co., Ltd., Archibald D. Dawnay & Sons, Ltd., J. H. Evans & Sons, Metropolitan-Vickers Electrical Co., Ltd., Murex Welding Processes, Ltd., Richard Nevill & Co., Ltd., C. A. Parsons & Co., Ltd., Rees & Kirby, Richardsons Westgarth & Co., Ltd., and Harland Engineering Co., Ltd.

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A Synthetic Material Resembling Rubber

The commercial applications of "DuPrene," a new synthetic rubber-like material, were discussed by Mr. O. M. HAYDEN, manager of the Du Pont Rubber Laboratories (U.S.A.), at a meeting of the London Section of the INSTITUTION OF RUBBER INDUSTRY on February 24th. "DuPrene," he said, was a chlorinated dutadiene, and thus resembled rubber to some extent in chemical composition and useful properties. It was superior to the natural product in its resistance to heat, ozone, ageing, and chemical and solvent deterioration, while its outstanding characteristic was its resistance to oil. It was also proof against "corona" effect. A major outlet for "DuPrene" in the electrical industry should be its use in the manufacture of protective insulating coverings for high-voltage wire and portable cables, particularly for neon signs, in which large quantities of ozone might be evolved. Cables with oil-resisting coverings were desirable in garages, the gun turrets of battleships and in engineering works generally. The heat-resisting properties of the material suggested its use in place of rubber in certain domestic electrical appliances, such as irons and hot-plates.

Messrs. A. C. Cossor lent an experimental electron-lens oscillograph to the author, whose investigations were carried out in the Electrical Engineering Department of Queen Mary College, University of London, under the guidance of Prof. J. T. MacGregor-Morris.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Publicity—and the Domestic Load

The last place in which one might expect to find reactionary observations on electricity supply is at a luncheon held under the auspices of the Electrical Development Association. Nevertheless, two of the speakers at the recent annual luncheon of the Northern Counties Area expressed views which, if acted upon, would prove inimical to progress.

The Lord Mayor of Newcastle said that, as we lived in an electrical age, all we had to do was to cheapen electricity: advertising was, in effect, unnecessary. But surely the cheapness of electricity depends upon the extent to which electricity is used for all purposes, and it can come into increased use only if people are made acquainted, by advertisement, of the services it can render. Experience has proved that cheapness alone does not increase demand; it must go hand in hand with an active sales policy.

Mr. F. C. Winfield, M.I.E.E., made the amazing remark that "domestic consumption is a mere trifle." He believes that electrical development can proceed only on industrial lines, that one rural industry is more useful than homes and cottages, and that merely to supply houses is a waste of money. No one will deny that a rural industry provides an extremely helpful load, but when it is realised that quite a small household is a potential consumer for 3,000 kWh or more per annum, there is no reason for dismissing the domestic load as a mere trifle. The estimates of a possible 47,000 million kWh annual output in ten or fifteen years' time are based to a large extent on the domestic load.

Since writing the above I notice that the latest report of the Electricity Commissioners emphasises the value of the domestic load. Mr. Winfield may be recommended to study the observations of the Commissioners on this point.

March 2nd. PROTONIUS.

Professional Incomes

A leading medical journal, which recently circulated a questionnaire, has published the statement that 50 per cent. of the doctors who started practice in 1930 are now making an income of £2,000 or over.

On the other hand, various Government appointments have recently been advertised for electrical engineers of similar status and experience, the salary offered being £400/£600, which may be assumed to be the market figure.

Can any of your readers tell me why, to put the matter quantitatively, the medical profession should be about four times as capable of looking after its interests as those engaged in electrical engineering? J. N. SCAIFE, B.Sc., A.M.I.E.E.

London, N.3, *February 28th.*

Automatic Cooker Control

Many of those who have expressed their views on this subject in your pages refer to the automatic control of gas cookers. But owing to the ventilation it is necessary with a gas cooker to have a variable flame setting to maintain a particular temperature; for this reason infinitely variable control becomes essential.

Electric ovens, however, are made by most manufacturers with one ventilator only, which, when fitted at the top is of such a size and shape that for practical purposes there is no ingress of cold air. If fitted at the bottom, size and design matter little. In those cases where two ventilators are fitted it is not necessary to have both open at once. Thus we have a non-ventilated oven not affected by short-period changes in room temperature. In addition to this the amount of lagging in most cases is such that with usual room and cooking temperatures the acceleration of heat loss caused by difference of temperature gradient is so small that for practical purposes one heat setting suffices to maintain any oven temperature during the periods usually required for domestic cooking. Thus there is no need for infinitely variable or thermostatic control.

Mr. A. D. Constable's last paragraph if construed as referring to ovens is directly opposed to my experience. A preheating period of 15 to 20 minutes is not unduly long compared with gas, and it is quite possible to place food in a modern electric oven, go out shopping with a happy heart and return at the allotted hour to find your meal perfectly cooked. Very few housewives using gas could do this with any confidence, even if they had "Regulo" control.

The ideal oven control is a four-heat one which would attain 400 deg. F. in 15 minutes; increase 35 deg. F. in one hour from 425 deg. F.; maintain 400 deg. F., or increase 10 deg. F. in one hour from 400 deg. F.; and decrease 25 deg. F. in one hour from 425 deg. F. All the foregoing at declared pressure and with empty oven. It is to be noted that using a slightly falling temperature benefits some dishes.

Many thermometer breakages would be prevented by shaping the guard to prevent a sudden rush of cold air past the bulb upon opening the oven door. Scales should be standardised and I favour Fahrenheit temperature markings.

Hotplate control is very difficult as fluids boil at different temperatures and have different latent heats. There is, however, room on many cookers for a much lower setting to avoid using a single pan half off the plate. Fine control is not essential as a competent cook uses the electric oven whenever possible as then even vegetables need no attention. The heat insulation of ovens should, if anything, be increased.

Voltage regulation as it affects all apparatus is really no concern of cooking. With a lagged oven a variation producing a temperature difference of, say, 20 deg. F. in one and a half hours will be of such a magnitude as to require immediate treatment. I have found that in every case where the difference between gas and electric ovens has been simply explained even former "Regulo" users have expressed satisfaction with switch control. H. G. BATSON, Associate I.E.E.

Worcester, *March 1st.*

Distant Load Indication

At a 60,000-kW generating station with which I am connected, it was considered desirable to have a load indicator in the boiler house. As the station has not been selected by the Central Electricty Board, it will not run much longer and therefore the expense of an electrical load indicator was thought not to be warranted. An optical method was adopted. Figures denoting the megawatts are suspended from a bracket in the control room, lit up by a lamp. A mirror was placed at the back of the economiser, so that the figures could be read off easily behind one of the boilers. By means of extra mirrors the readings are taken in the centre of the boiler house.

For the figures, the tens might be red on white and the units black on white. An even number of mirrors is desirable, but if an odd number is necessary, enlarged playing cards, (4 in. by 6 in.), can be used, the figures being expressed by the number of red or black pips.

Mirrors should be attached to girders or walls in order to avoid vibration, which would cause distortion.

Leeds, *February 25th.* W. E. PRITCHARD.

Circuit-breaker Closing

Is the successful performance of an electrically closed oil circuit-breaker, when making contact during a short-circuit test, proof that an operator can and will, in practice, apply the same powerful and continuous closing effort (so necessary to safe closing) when he encounters the repulsive "throw-off" forces at the instant of contact "make" on short-circuit?

Even with the circuit-breaker in which the resistance to short-circuit forces has been proved by the actual passage of short-circuit current on test, safe closing by hand is determined (as with all circuit-breakers) by the value of the repulsive force on the contacts to be overcome by the closing effort of the operator at the instant the contacts touch. The value of this repulsive force is dependent on the magnitude of the peak amperes. Moreover, the operator is not aware that a fault exists and is, consequently unready to apply the necessary large effort at the right moment to ensure that there will be no hesitation or slowing down in the closing action which might result in contact welding and dangerous conditions.

Where a solenoid is employed for closing the breaker, the solenoid is designed to give a pull definitely greater than the maximum throw-off force which may be encountered within the maximum rating of the circuit-breaker. GANDER.

February 29th.

"Parliamentary Lamps"

One scarcely looks for laughs in your "Parliamentary News," but the statement by the First Commissioner of Works (page 322 of your current issue) that "the substitution of gas-filled lamps where available took place as the old types wore out" seems good enough for *Punch*, though some of your readers may think it tragic that vacuum lamps are still eking out a subdued existence in the gasfilled purlieus of our Houses of Parliament.

Incidentally, one might be pardoned for wondering whether the Commissioner really meant "worn out" or whether the lamps are in fact replaced when they are only "burnt out."

BERNARD C. HOLDING.

London, W.C.1, *February 28th.*

Electricity Supply Progress

The Commissioners' 15th annual report

THE fifteenth annual report of the Electricity Commissioners covers the twelve months ended March 31st, 1935 (Stationery Office, 3s.). It shows that the total kWh generated in 430 stations of 630 separate authorised undertakings (252 company-owned) was 15,890 million, over 12 per cent. above the figure for the previous year and 50 per cent. above that for 1929-30. The average number of kWh per ton of coal has increased from 1,200 in 1930 to 1,425 in 1934. Nineteen fewer stations are included than in the previous return owing to the closing of twenty-nine and the commissioning of three new and one stand-by stations and the inclusion of six previously non-statutory stations. In the 129 selected generating stations 82 per cent. total output was generated. Sales by authorised undertakings (excluding bulk supplies to other undertakings) amounted to 12,782 million kWh, equivalent to 281 kWh per head of population.

The Bedford Rural Undertaking

An important section of the report relates to electricity supply in the two rural demonstration schemes of Bedford and Norwich. The Bedford scheme covers an area of about 109 sq. miles with a population of about 19,000 and containing 6,260 occupied dwellings. The Treasury is advancing for not more than ten years sums not exceeding £8,000 to meet 75 per cent. of any annual deficits. The scheme, which was officially started on April 1st, 1930, is treated as a separate undertaking, receiving a bulk supply from the Corporation at (in 1934-35) £3,707 per kW of m.d. plus 0.1812d. per kWh. Of the 226 miles of transmission and distribution lines (including 64 miles existing at the outset of the scheme) 125 miles was overhead.

During the year the number of consumers increased by 409 to 4,496 (4,267 domestic and shops), representing nearly 72 per cent. of the number of dwellings. Sales went up by nearly 55 per cent. to 8,072,000 kWh, the advance being accounted for by 2,000,000 kWh for power and 800,000 kWh for domestic (including shops); for the latter the total consumption was 2,977,000 kWh or 698 kWh per consumer at an average price of 1.5d. Most of the 4,776,000 kWh sold for power at 0.53d. (average) was taken by a large brickworks. Farms (215) took 318,000 kWh at 1.57d. The overall average price was 0.93d. per kWh. Revenue increased by nearly 39 per cent., that obtained from domestic premises and shops averaging £4.35 per consumer; this represented a substantial advance upon the figure of £3.8 in the previous year.

The number of cookers installed (1,533) on hire or hire-purchase terms represented 35 per cent. of the domestic premises and farms. There were also 138 wash-boilers and 141 water-heaters installed under the scheme and 993 assisted-wiring installations.

Capital expenditure, including £69,000 before the inception of the scheme, came to £236,000. Revenue expenditure was £26,000, more than half of which was due to cost of energy, and the revenue was £35,000, of which £15,700 was received from two-part tariff supplies. Capital charges of £15,000 absorbed the gross surplus, leaving a deficit of close on £6,000, about £360 more than in 1933-34.

The Norwich Scheme

The Norwich demonstration area covers 125 sq. miles, has a population of 13,744, and contains 3,872 occupied dwellings. Fifty per cent. of the interest for fifteen years on £41,000 is allowed by the Government grant. The scheme was started in November, 1930. The bulk supply charge in 1934-35 was £2.875 per kW of m.d. at the Norwich undertaking's peak plus 0.133d. per kWh.

Transmission and distribution lines, exclusive of the ring main which serves other districts, had a route length of 170 miles (93 per cent. overhead). During the year the number of consumers increased by 280 to 2,262; 78 per cent. of the 1,769 domestic consumers occupied premises with a rateable value of under £10. Sales of electricity increased by 14 per cent. to 949,000 kWh, of which 757,000 (364 per consumer) were taken by domestic and shop premises at 2.19d. per kWh (£3.3 per consumer), 113,000 by 168 farms at 1.97d., and 78,000 by 18 factories at 1.52d. The number of cookers on hire or hire-purchase was 461, representing twenty per cent. of the domestic premises and farms connected.

Capital expenditure on the scheme (exclusive of ring main) stood at £108,000. Revenue expenditure amounted to £5,259, of which £1,407 was for energy. Revenue received totalled £9,500, of which £4,590 came from two-part tariff consumers. Capital charges of £7,300 absorbed the surplus and left a deficit of £3,068, compared with £3,453 in the previous year. Loan charges have been calculated to show the results of independent operation of the scheme, *i.e.*, full provision is made for sinking fund.

Certain electricity district authorities and companies are under obligation to supply electricity in undeveloped parts of their areas, and particulars are given of the progress made in each case. Reference is also made to a meeting of the conference on rural supply.

The work of the Joint Electricity Authorities and Advisory Committees is reviewed and the new standard prices for the London companies are tabulated.

New Generating Plant

The aggregate capacity of new generating plant sanctioned amounted to 594,449 kW, compared with 114,096 kW in 1933-34 and 550,000 as the average of the past fourteen years. Consents issued for the establishment of new stations numbered six (three non-statutory) for an aggregate plant capacity of 3,820 kW. Extensions sanctioned for existing stations represented 357,705 kW for public authorities, 212,789 kW for companies, and 20,185 kW for transport and non-statutory undertakings. These figures included 555,075 kW (made up of one 75,000, four 50,000, seven 30,000, two 25,000, and one 20,000 kW sets) in selected stations, in addition to which the installation of boilers with a steaming capacity of 2,595,000 lb. per hr. in excess of that needed by the new turbo-alternators was approved.

Methods of testing dust-extraction plant and of grading dust particles are under investigation, and are to form the subject of a B.S. Specification. The Commissioners have requested undertakings when constructing any new chimneys to make provision for flue-gas testing. Reference is made to the successful results obtained with the gas-washing plant at Battersea, and the conditions of approval of the means of sulphur elimination to be adopted at Fulham.

Among the consents for the installation of main transmission lines were two for 66-kV, one overhead for the S.W. & S. Co., and one underground for the London Power Co. The majority of the other consents related to the installation of 33-kV transmission systems.

Special Orders were made in twenty-three cases. Of the eighteen applications received during the year four related to the establishment of new undertakings, four to extensions of area, seven to transfers of undertakings, and three were from competing undertakings. Particulars are given of each application. Fringe Orders were granted in 160 cases and revoked in 73 cases.

The number of applications (1,003) for borrowing was the largest on record. Sanctions were issued to 979 loans amounting to £18,239,000 (exclusive of the Central Electricity Board), an increase of forty-two per cent. over the previous year. Plant accounted for 31.9 per cent. and mains for 36.8 per cent. of the total.

Bulk supplies were given by 158 undertakings and taken by 398 undertakings (apart from the Central Electricity Board's operations). In addition, 1.3 per cent. of the gross public supply was received in bulk from non-statutory sources. Approval was given during the year to seventeen arrangements for mutual assistance or bulk supplies.

Changes of System

A list is included of the twenty-seven undertakings to which consents were issued for alterations in the declared systems or voltage. Nineteen of these were for converting from d.c. to a.c. (four to non-standard voltage). Approval was given, with the concurrence of the Postmaster-General, for multiple earthing by five undertakings and to the adoption by eight undertakings of the ± 6 per cent. voltage variation limits for supplies which were commenced before January 15th, 1934.

The use of high-frequency current on the neutral conductor for remote control of public lighting was assented to in seven cases; this necessitated the insertion of an impedance, *i.e.*, the secondary winding of a h.f. transformer, in the earth connection. Four consents were issued to the use of high-voltage electrode boilers, which implied the earthing of the h.v. system at more than one point, subject to their automatic disconnection with a maximum of fifteen per cent. sustained out-of-balance current between phases.

Ten awards by referees regarding compensation for loss of office, results of five applications for downward revisions of maximum prices, and seven cases of revocation of powers are detailed. During the year 3,572 applications for overhead lines (23 per cent. increase) and 120 applications for wayleaves were dealt with.

Administrative expenses of the Commission amounted to £54,000 or 1.18d. per 1,000 kWh sold by authorised undertakings. Frequency standardisation expenses, which are also apportioned among the undertakings in proportion to receipts from the sale of electricity (but in this case exclusive of bulk supplies given), amounted to as much as 18s. per £100 of such revenue.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Quiet Fractional H.P. Motors

The BRITISH THOMSON-HOUSTON CO., LTD., Rugby, is putting forward fractional h.p. capacitor and split-phase motors designed especially for quiet operation. While the noise inherent in any type of motor may be minimised, it is more important to prevent its transmission through the driven machinery, when great amplification may occur. As noise is often due to the location of the motor and not to a fault of the machine, the motor frame is isolated from its drive and from its base frame-work.

A ¼-h.p. split-phase induction motor with resilient mounting and automatic belt-tension adjuster

If the frame is isolated by mounting it on rubber cushions placed round the bearings, the rubber is held in shear against torsional vibration and in compression against axial forces — an arrangement that promotes quiet operation.

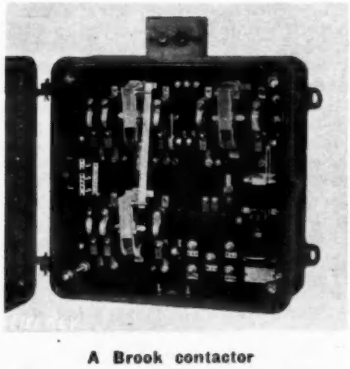
Noise caused by end-bumping of the rotor-shaft shoulder against the bearing, due to minute inaccuracies in alignment of the drive, is eliminated through control of rotor end-play by an indestructible steel diaphragm allied to a cushioning device.

An automatic device for adjusting the belt tension is available for obviating noise from belt drives. The machine is rubber-mounted in an inner base and pivoted in an outer base. The tension is provided by torque reaction about the outer-base pivots, the belt being automatically tightened for heavy starting loads, which for compressors may be three times the running load, and slackened afterwards.

The resilient automatic belt-tension adjusters can now be supplied for capacitor motors of from ¼ to 1 h.p. for split-phase motors of ¼ h.p., and for certain sizes of d.c. machines; but it is proposed to extend their application to all B.T.H. fractional-h.p. motors.

Capacitor-motor Starters

A range of contactors is now being made by MESSRS. BROOK MOTORS, LTD., Huddersfield, for enabling squirrel-cage, single-phase capacitor motors up to 7½ h.p. at 200 to 250-V, 50 cycles, to exert fifty per cent. torque at starting with not more than full-load current. With high-torque motors the effort is seventy-five per cent. f.l.t. under the same conditions. No resistances are employed, the operation consisting of a change of connections only. The contactor is automatic with over-load protection, adjustable time relay and push-button control; when in the off position it completely isolates the motor from the line. Wiring is at the back of the board and metal parts (including the magnets) are plated.



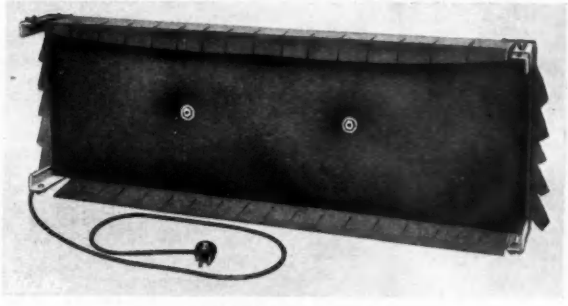
A Brook contactor

The whole of the starter is enclosed in a cast-iron box with sheet-steel sides and a cast-iron hinged lid. Motors operated in conjunction with this type of contactor are mechanically standard, but have special windings and connections; their power factor is above 0.9 at full load.

The " Cosy " Brooder

MR. JOHN BEE, Sunny Bank, Hambleton, Blackpool, in designing the new " Cosy " brooder, has endeavoured to construct an electrically operated brooder which will give the nearest approach to natural conditions.

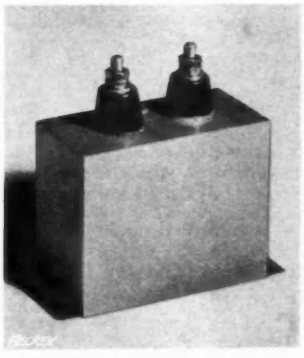
A feather-filled felt pad covers the element, the heat of the pad, which is in contact with the backs of the chicks being as near as possible to that of a hen when brooding. The legs of the brooder are adjustable in order that it can be raised as the chicks grow. Mr. Bee claims that heavy breed chicks, feathered to the tail, can be reared in six or seven weeks. The loading of a brooder large enough to accommodate 200 chicks is 110 W, and the design is such that should the supply fail, the brooder will keep warm for several hours.



The " Cosy " brooder

Condensers for Motors and Neon Signs

A range of small condensers for " built-in " applications, such as capacitor motors, or for improving the power factor of neon signs has been developed by the WEGO CONDENSER CO., LTD., Bideford Avenue, Perivale, Middlesex. The units are hermetically sealed in metal cases and are impregnated with " Aroclor," a non-inflammable, non-explosive liquid possessing high insulating properties. They are designed for continuous operation on voltages up to ten per cent. above their rated figures at frequencies of not more than 60 cycles per second and at ambient temperatures up to 75 deg. C. They may be used for motor starting at double the rated voltage, as they are tested at those values and at 2,000 V a.c. from terminals to case. Stock dimensions for 400-V working are from 3½ by 1 by 1½ in. for 2 μF to 3¼ by 7½ by 2¾ in. for 20 μF., and for 250-V working from 3¼ by 2½ by 1½ in. for 5 μF or less, to 5 by 4 by 3½ in. for 50 μF.



A new " Wego " condenser rated at 7.5 μF 400 V a.c.

An Improved Ceiling Switch

Several improvements have been incorporated in the new " Lincoln " ceiling switch made by MESSRS. J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall. Although the base is only 2 in. in diameter, the wiring terminals have been increased in size to make " looping " easier, and the mechanism is attached to the base quite independently of the bridge so as to give it greater mechanical strength.

The spring is totally enclosed to prevent the entry of grit, and the whole action is smooth, but positive. The sample which was sent to us for examination has a brown bakelite cover on brown porcelain, but we are informed that brown and white or all-white designs can be obtained, while surface and semi-recessed types are available.

The new " Lincoln " ceiling switch

Rubber Splicing Compound

A rubber tape interleaved with red protective glazed cloth with a minimum tensile strength of 250 lb. per sq. in. is now being manufactured in Great Britain by ROTUND, LTD., Denton, Manchester, under the name of " Slipknot " rubber-splicing compound. The material is claimed to mould itself, without heat or vulcanisation, into a solid rubber insulating joint that will withstand a dielectric test of 10 kV for five

D

minutes and is, therefore, suitable for conditions for which portable vulcanisers have hitherto been considered necessary.

In addition to its use for joints on v.i.r. insulated and tough-rubber-sheathed conductors generally, a special field is for cables under the bodies of tramcars and trolley-buses that are exposed to dirt and wet or for lighting and signalling cables in collieries (though not for trailing cables subjected to rough handling). "Slipknot" compound is made up in 8-oz. ¾-in. wide coils, but greater widths are obtainable.

Some New "Bylock" Appliances

BYLOCK ELECTRIC, LTD., 109, South Street, Ponders End, is extending its range of appliances to include a hair dryer and a floor polisher. The hair dryer is small, measuring only 7 in. by 8 in. and weighs only 2 lb. It has a metal casing in a pleasing finish of mottled grey enamel, and a three-way "in-line" switch incorporated in the flex, with "off," "cold air" and "hot air" positions. A combined two-pin plug and lampholder adaptor is provided.

The new "Bylock" hair dryer

The floor polisher is designed on orthodox lines and has the same finish as the hair dryer. There are two revolving brushes; these are used for polishing and a spare pair, which is easily interchanged, is kept for waxing. The control switch is situated in a convenient position at the top of the handle, and, as is the case with the hair dryer, it can be obtained with three-core flex and a three-pin plug for earthing.

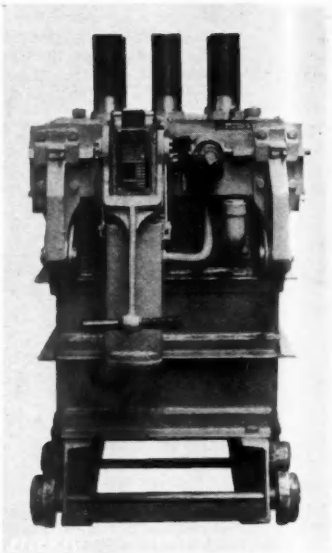
Improvements in the company's vacuum cleaners are also announced, including the provision of two fans, which Mr. A. J. Evans, the London sales manager, informs us gives an increase of 30 per cent. in the suction.

Electrical Towel Rails

A moderate-priced electric towel rail with a totally-enclosed heating unit, which is easily detachable and can be fixed in either of two positions, has been produced by MESSRS. R. T. NORTON & Co., 1, Bray Place, Sloane Square, London, S.W.3. Weighing 10¾ lb., it is sturdily built of 1-in. steel tubes, heavily chromium plated, with a cream coloured guard, and it measures 2 ft. 10 in. wide, 2 ft. 10 in. high, and 6 in. deep. The 300-W heating element is carefully insulated from the frame and provision is made for earthing. The top rails are detachable for shipment.

Manual Closing of Switches

A compact spring-loaded closing mechanism which enables manually operated circuit-breakers to be closed by hand with safety under short-circuit conditions, quite independently of the operator's effort at the instant of contact-make, has been designed by SWITCHGEAR & COWANS, LTD., Old Trafford, Manchester. This device is attached below the standard operating mechanism and lies conveniently within the normal frontage of the switchboard.



The spring loaded closing device as it appears mounted on the normal operating mechanism of an S. & C. circuit-breaker

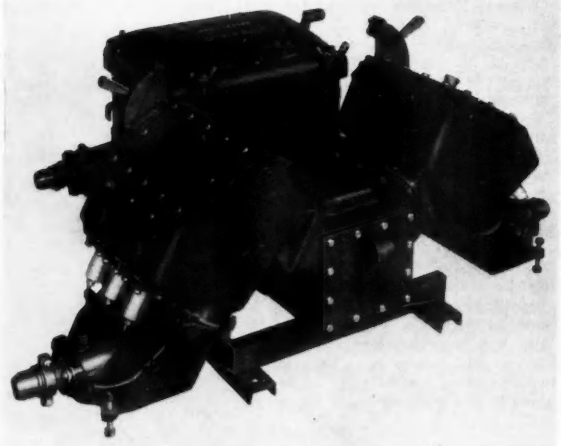
A Matched Di-pole Aerial

A recent product of AERIALITE, LTD., Junction Mills, Whittington Street, Ashton-under-Lyne, is a matched di-pole aerial kit with sockets for long, medium and short-wave reception. A transformer is incorporated so that the impedance may be matched with the receiver, and the 50 ft. aerial is divided centrally into 25 ft. lengths separated by glass insulators.

An Underground Ring-Main Switch Unit

FOR use on 11-kV underground ring-main distribution systems MESSRS. LONG AND CRAWFORD, LTD., Gorton Road, West Gorton, Manchester, 12, have introduced a three-way equipment for manhole or below-ground chamber work which is watertight and can actually be operated under water. It consists essentially of two sets of 300 A. triple pole, quick break, oil-immersed switches for controlling either side of a ring-main, coupled directly to an oil fuse switch for a tee-off, the whole being arranged as a self-contained, totally enclosed, oil-filled unit.

Each ring-main switch is provided with a removable oil-tight cover. The switches are fitted with flicker blades and each is operated by a removable exterior handle; the switch contacts are mounted on robust porcelain insulators through which the connection stems are taken into the cable box and terminal chamber.



The Long and Crawford ring-main manhole switch unit

Earthing and testing points, when required, are fitted inside the switch chamber and are so arranged that it is first necessary for the switch blades to pass through the earth contacts, thus earthing the cable before the three cores are connected to the test position. Four positions are provided on each switch handle, namely, "on," "off," "earth," and "test," the handle being so interlocked that it is impossible for an operator to pass it inadvertently from the "off" to the "earth" position.

The horizontal cable-entry trifurcating boxes, each complete with a brass wiping gland and armour clamps, are split to facilitate cable jointing, the cable cores being connected to the switch terminals by means of cast copper mechanical-grip connectors.

The earth terminals are connected together by means of a common copper bar brought out to an external earth strip and the test terminals are brought out to a position readily accessible from the outside of the gear, thus dispensing with portable testing plugs. These terminals are designed to withstand a test pressure of 30,000 V, a provision which allows for the testing and breaking down of high-resistance faults in the cable.

The upper end of each ring-main switch casting is bolted to a cast-iron oil-filled terminal chamber which, in turn, is bolted to a 100-A, 11,000-V "U" type tee-off rotary oil fuse-switch. The connections between the ring-main tee-off switches are made in this chamber.

The 100,000-kVA, 11,000-V tee-off switch has a welded sheet-steel tank fitted with a substantially hinged, cast-steel, bell-type cover, interlocked with the switch mechanism, and an air-filled chamber is provided in the top part of the tank into which the fuses are automatically raised when switching off. Access to the fuses in this compartment is gained by raising the top cover, which causes a safety shutter to close the aperture through which the fuses have passed when travelling from the "on" to the "off" position. In this manner the fuses are isolated entirely from both line and load in the "off" and rewiring position and are easily accessible, accidental contact with live metal being impossible.

An externally operated handle is provided, but the switch parts and operating mechanism are contained in the tank, the fixed contacts being mounted on oil-tight porcelain insulators which also take the connections into the terminal chamber and the tee-off cable box. This cable box is also designed for a horizontal cable run. It is bolted to the side of the switch tank near the bottom and is split to facilitate laying in the cable.

A gland is fitted at either end of the box to suit the run of the cable. Earthing and testing points can also be fitted to the tee-off cable box when required.

The Brazilian Electrical Appliance Market

From a Correspondent

BRAZIL presents a market for certain types of electrical household appliances, but there are important factors to be considered. The purchasing power of a portion of the people is so low that they can afford neither the initial price nor the cost of electricity for operating the devices. Further, the more well-to-do housewives seldom take an active part in the work of the household, so that there is not the same pressure to relieve the burden of household work by the installation of labour-saving apparatus. The principal demand is for those appliances of the luxury type, or those from which the family will derive direct benefits, such as radio apparatus, refrigerators and polishing machines.

Figures showing the extent of national production are not available for the whole of Brazil. Statistics for the State of Sao Paulo, however, reveal that in 1934 there were nine firms, with an aggregate staff of between three and four hundred, producing household electrical equipment. The capital invested amounted to approximately £37,000. The production of these factories has been reported as 411 refrigerators, valued at £23,700; 2,600 radio sets, valued at £20,400; 5,000 electric irons, valued at £1,930; 2,133 hot-plates, valued at £521; and 1,264 heaters, valued at £490.

In Rio de Janeiro one of the most important American manufacturers of electrical equipment of all kinds has a large factory which caters extensively for the local market. There are also firms making general heating and cooking devices, refrigerators and radio apparatus.

In addition to that offered by the local manufacturing concerns, there is keen competition from foreign firms who have opened branch distributing offices in Brazil. These branch offices, besides taking care of distribution and general sales, operate assembling plants and repair shops. The American firm mentioned has entered the retail field and sells direct to consumers through its own shops and a controlled chain. The same procedure is followed by other firms.

Electric Irons

Prior to 1933 no attempt was made in Brazilian statistics to classify any of these appliances, but since then refrigerators, flat irons and radio apparatus have been dealt with separately. All other imports come under the heading of "electrical machinery and apparatus, n.o.p.," which covers such a wide field as to make it valueless for a report of this nature. C.i.f. and wholesale prices are difficult to procure, but wherever possible general price indications will be given, more as a guide for comparison than as a definite statement of ruling prices.

In 1933 a total of 33,824 kg. of electric irons, valued at £3,000, were imported. For 1934 the figures were 27,377 kg., valued at £2,617; Germany supplied the greater part, shipping 16,257 kg., valued at £1,560, followed by the United States, Great Britain, Italy, Japan, Norway and Sweden.

Locally made 2.7 kg. electric irons with 200-W elements and complete with flex, are sold retail at from 7s. 7d. to 12s., while imported irons range from £1 for the ordinary type to as much as £1 15s. 6d. for the automatic types. The duty on electric irons, chromed or nickelled, is 1s. per kg., while those made of other common metals are assessed at 2s. per kg.

Hot-plates and Percolators

Electric fans are used extensively in restaurants, shops, offices and theatres, but the cost of electricity limits their use in private houses. American, German, British and Italian companies maintain stocks of all types and sizes of fans. The following are the average prices for 10-in. oscillating fans: American, £2 4s.; Italian, £2 2s.; and German, £1 7s. 6d. Electric fans are subject to an import duty at the rate of 1s. 5d. per kg.

Small single-element hot-plates are fairly popular in Brazil, and, perhaps, next to electric irons, enjoy the greatest sale. The production of hot-plates in Sao Paulo in 1933 amounted to 2,132 units valued at £721. There are no other Brazilian statistics available, but the United States returns indicate that in the same year, under the heading of "Other heating and cooking devices, electrical," 907 units valued at £552 were exported to Brazil. A locally made hot-plate with a diameter of 120 mm. and a 450-W element is retailed complete for 4s., and a second with three heats (400, 600 and 1,000 W) retails for 15s. A two-element hot-plate retails for 24s. 6d. The duty on hot-plates is 2s. per kg.

The Continental-type breakfast is customary in Brazil, hence there is, comparatively speaking, little general demand for toasters. The greatest sale is among British and American residents. One local firm manufactures toasters with 500-W elements, retailing at 12s. 6d. Imported toasters are listed at from 18s. to 27s. 4d., and automatic toasters retail at around 38s. The duty on toasters is 1s. 2d. per kg.

The method of preparing coffee which is invariably employed in Brazil is to use a drip bag, this being considered more satisfactory than a percolator. There have been one or two local attempts to produce electrical coffee appliances. One of these, holding 1½ litres, retails at 11s. 3d., while another sells at £1. There are a few imported percolators, of the four-cup size, to be seen in the shops; these retail at £2 5s. The duty on percolators works out at 6½d.

Electric Stoves and Refrigerators

There is not much scope for electric cookers. In the larger cities gas is available, and for cooking purposes it is cheaper than electricity. American and German organisations have embarked upon extensive advertising programmes on more than one occasion with but little success. Such demand as exists is confined almost entirely to small one- or two-element table cookers, a locally manufactured model selling at about £4, while imported cookers of the same description retail at from £7 15s. 6d. to £13 6s. 9d.

The use of electric refrigerators is, perhaps, showing a greater expansion than that of any other single type of electrical household equipment, with the exception of radio receivers. In 1933, the total imports were 185,211 kg., valued at £30,446. In 1934, however, the total reached 719,000 kg., valued at £114,000. The United States enjoys the bulk of this trade. The value of the imports from that country, according to Brazilian statistics, was £28,140 in 1933 and £106,470 in 1934. In the latter year Germany and Argentina shipped refrigerators to the value of £3,195 and £2,556 respectively.

In the State of Sao Paulo there are three firms which make refrigerators. Their total production in 1933 was 411 units, valued at £22,853. There are two manufacturers in Rio de Janeiro whose products are steadily gaining in favour. There would seem to be great opportunity for expansion in Brazil, most of the present demand being confined to commercial use. Prices of refrigerators vary according to type; the most popular run from £22 4s. 5d. to £88 17s. 8d., with a limited demand for the extra-large or de luxe types at £100 to £111. Rates of duty vary according to weight classification.

Vacuum Cleaners and Floor Polishers

The demand for labour-saving machinery, under which heading come vacuum cleaners and floor polishers, is relatively small; floor polishers undoubtedly enjoy the greatest demand. Probably the larger share of the demand is met by a Swedish firm, which sells direct to consumers on a liberal time-payment basis. Its polisher retails at approximately £10 16s. Following the lead of this company, an American and a German house, selling at prices of about £13 7s. and £8 7s. respectively, are now offering long-term payments. The same sales methods are adopted for vacuum cleaners, but the demand is small. Primarily because of insects and heat, waxed floors are almost universal. The duty on vacuum cleaners and polishers is 9d. per kg.

For a period of three years imports of washing machines into Brazil from the United States totalled 382 units, valued at £5,600. This would probably represent at least 90 per cent. of the total imports. Washing in Brazil is generally done by hand, and few are interested in spending money on electrical equipment for this purpose. There are comparatively few large laundries; but there is a multitude of washerwomen calling for and delivering clothes who will do all washing and ironing for a family of four for about £1 a month. A large American firm, with its own sales organisation and a repair shop with expert mechanics, offers liberal terms of payment and has, with considerable advertising, been able to sell a number of machines which are, to a great extent, included in the import figures given above.

Good Demand for Radio Apparatus

No statistics are available which indicate the number of radio sets in operation in Brazil, but it is in radio that the best opportunities for sales exist. The local industry is as yet small. In Sao Paulo there are two firms manufacturing radio receivers, and one in Rio de Janeiro. In 1933 the total output of the Sao Paulo firms was 2,600 units, valued at £20,800.

Imports of radio apparatus in 1933 amounted to 431,000 kg. and were valued at £153,000. In 1934 the amount increased to 677,000 kg., valued at £243,560. The United States obtains about 75 per cent. of the market, the value of the imports from that source in 1933 being £125,200, and in 1934 nearly £200,000. United States' statistics indicate that in 1933 there were shipped to Brazil 38,274 receiving sets, valued at £140,000. In value, Great Britain and Holland share the major part of the remaining imports. In 1933 the value of the imports

from Great Britain was £14,060, and from the Netherlands £28,220. In 1934 those from the Netherlands reached a value of £26,667, against £13,080 from the United Kingdom. Germany was credited with £806 in 1933 and £4,927 in 1934. Owing to high duties, radio sets are imported without cabinets. The values represent chassis and parts only.

Most of the better-known American manufacturers are represented in the Brazilian market, and several of the Continental ones as well. Prices are comparatively even as between the different selling companies. One Netherlands firm retails a six-valve set for £14. A five-valve table model from the United Kingdom retails for £13 6s. 9d., while an eight-valve set costs £27 15s. 8d. American firms retail six-valve table sets at £17 15s. 9d., and a console model of the same type for £50.

As there has been very little development in the local industry, most of the spare parts are imported, even in the case of the foreign firms who maintain their own factories and workshops. The duty on radio sets and parts weighing up to 10 kg. is at 3s. 2½d. per kg., from 10 to 50 kg. at 2s. 6½d., from 50 to 100 kg. at 1s. 11d., and from 100 to 250 kg. at 1s. 9d.

The Brazilian market for radio apparatus has not reached saturation point; new installations are still far in excess of replacements. It has been estimated that it will be another two years before an appreciable diminution in radio sales is observable, and it is hoped that by that time replacement business will have developed to such an extent that there will be little falling off in the actual sales of radio apparatus.

New Books

Elements of Electrical Engineering. (Third edition). By A. L. COOK. Pp. 603; figs. 393. London: Chapman & Hall, Ltd. Price 20s. 603 pages.

This book is divided into four parts relating to electric and magnetic circuits, d.c. machinery, alternating currents, and a.c. machinery. It deals with the design of electrical machines as well as their operation, and also with transmission, distribution, instruments, batteries, illumination, vectors and complex quantities. Electro-communication work is not included, and the section on the oscillograph does not mention the cathode-ray type. Design is dealt with in by far the most thorough manner. At the end of each of the forty-two chapters, there is a list of problems appropriate to a book for students.

The opening sentence of the author's preface says: "This book deals with the fundamentals of electrical engineering and their application in practice." The second-part of the sentence is more true than the first, for the derivations of the most fundamental principles and formulæ used in electrical engineering are not given. The formulæ are set down as in a pocket book, to be remembered, not to be proved. A formula is given on p. 85 for the result of capacities in series without explaining the reason why it is the reciprocals which are added. Formulæ for overhead line constants are similarly quoted, but not derived, and no reason is given for the difference between the practical, electrostatic and electromagnetic units, for which a table is provided. It must also be somewhat confusing to the student to find a factor ρ on p. 47 which is "dependent on the kind of material comprising the magnetic circuit," and never to meet this symbol again, but to find on the next page μ with no word to explain that one is the reciprocal of the other. A number of similar examples could be quoted. For those satisfied with the amount of fundamentals to be obtained from pocket books this book will serve a useful purpose. It is well illustrated with line drawings and photographs of standard apparatus. These are well chosen from current practice. The style of the writing is clear and the printing and general arrangement are pleasing to the eye and make for easy reading.

Boiler Feed Water Treatment. By F. J. MATTHEWS. Pp. 256; figs. London: Hutchinson & Co. (Publishers), Ltd. Price 12s. 6d.

The author sets out mainly to help the engineer in small power plants, who has no chemist to supervise treatment of the water. The book should, however, be useful to others.

It is divided into five parts, the first of which gives a useful introduction to the composition of water from various sources. Part two, on scale formation, describes clearly the cause, the mechanism of deposition, the effect of modern conditions, and is instructive on heat transfer from furnace to water. A description of softening processes follows, with an account of sodium aluminate as an aid to softening and as a preventative of silicate scales. The remarks on condensate as a feed are concerned chiefly with small plants, and hardly apply to a modern power station where the water is almost free from dissolved gases. Moreover, in detecting small condenser leakages, the author might have mentioned the effect of possible saline matter in the steam on the tests described. The theory and practice of carbonate and phosphate conditioning is efficiently dealt with, the inclusion of curves and tables making it helpful for reference.

Many books have been written on corrosion alone, and it is no easy task to give so much in sixty pages. The author gives first an account of the underlying theories, then stresses the importance of dissolved oxygen in the modern conception of U. R. Evans. He explains the mechanism of pitting and the use of corrosion inhibitors. The section of de-aeration might with advantage have included a description of a modern closed-feed system with its centrally ported extraction pumps, and de-aeration of make-up in condensers. Part three also deals with corrosion by soft water, unstable salts and carbon dioxide, including any effects in turbine and superheater. The section on caustic embrittlement appears to be rather too alarming in view of its controversial nature, but the collection of information and the clear description of pH values are good.

Foaming and priming, with their cause and remedies both physical and chemical, are given due prominence in part four, followed by a description of analysis and testing in part five. The latter will be of more use to the engineer than to the trained chemist. For a book of only 250 pages, it covers the subject remarkably well, and is to be recommended with confidence. A useful bibliography is included.

Electricity in the Home and on the Farm. By F. B. WRIGHT Pp 320; figs. 66. London: Chapman & Hall, Ltd. Price 12s. 6d.

This is one of the "Wiley Farm Series" of text-books published in New York by John Wiley & Sons, Inc. In this particular book, however, the words "and on the farm" in the title are rather misleading. There is practically nothing in the text to justify them: the only reference to anything like a special application of electricity to agricultural work is in seven pages describing the installation in a poultry shed of an alarm system and a dimming circuit. For the rest, the book is written no more for the farmer than for any urban householder. The author himself states that it "is designed with the needs of the school shop teacher in mind," and that indeed is its general scheme.

A little over a quarter of it is devoted to elementary theory and the broad outlines of motor and transformer design and a.c. distribution. The rest consists of a series of workshop experiments and practical jobs, graded from simple circuits to the building of a motor or transformer. Each is clearly described, with its material, tools and detailed methods, and is supplemented by the usual test questions. The whole is well and profusely illustrated.

Its value as a text-book for students in this country is somewhat discounted by its American setting, with, *e.g.*, its references to the National Electrical Code and the B. & S. gauge, but technical teachers may find its practical sections usefully suggestive. Its chief appeal, however, is likely to be to the "handyman."

Electric Arc Welding Practice. By H. I. LEWENZ. Pp. 126; figs. 103. London: Crosby Lockwood & Son, Ltd. Price 8s. 6d.

There is generally a time-lag between certain industrial developments and their chronicling in text books, but in the present volume the information, besides being comprehensive and practical, is up to date.

The first chapter is devoted to a survey of the different methods of joining metals—brazing, soldering and all types of weldings, while the second, on "Weldability of Metals," ferrous and non-ferrous, though only short, will form a useful reference chapter for the shop foreman who has not time to delve too deeply into the metallurgical side. The next portion of the book deals with different types of electrodes and the actual electric arc welding process.

After describing the various joints and chamferings in general use, the author passes on to the most valuable portion of his book, namely, "Stresses and Deformation." Expansions and contractions, preventable and otherwise, are fully explained for the benefit of the welder who is not necessarily mechanically-minded. The chapter on the welding of cast iron gives some good hints for hot and cold welding. After describing various methods of testing of welds, the book discusses possible arrangements of welding shops and types of welding plants which could be used. The several photographs of repairs and constructive work possible with the electric arc are very helpful.

We regret that the author was unable to find space to deal with welding errors and their probable effect on the test results.

The book can be thoroughly recommended to those practical men for whom it was written, and could be read with benefit by those on the design side of the business.

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Shorter Notices

"A Class Book of Magnetism and Electricity," by H. E. Hadley. Pp. 512; figs. 432. London: MacMillan & Co., Ltd. Price 6s. 6d.

"The Superheterodyne Receiver," by A. T. Witts (Second edition). Pp. 160; figs. 83. London: Sir Isaac Pitman & Sons, Ltd. Price 3s. 6d.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

A Useful Guide

With this issue of the Electrical Review we are providing our readers with an alphabetical index of advertisers in our pages, giving their addresses and other information. As the list includes the majority of firms in the electrical industry it should prove a useful source of reference.

Wages in the Engineering Industry

Representatives of the Engineering and Allied Employers' National Federation and the engineering trade unions (including the E.T.U.) met in London on February 20th when a lengthy statement was presented by Mr. J. C. Little on behalf of the trade unions in support of an increase in wages. Briefly, the unions' case was that skilled engineering workers were receiving very low wages in comparison with workers of comparable grades in other industries; that the engineering industry as a whole was in a better position to pay higher wages than it was a few years ago; that during the depression many men in the industry had suffered unemployment and their standard should be raised as partial compensation; and that no improvement in trade would be permanent unless mass purchasing power was increased. The statement set out in some detail the prevailing rates and wages in the engineering and other industries, and showed that there had been a rise in the cost of living since 1933. Figures were quoted to show that export trade had improved in recent years and that in 1934-35 Great Britain regained the position of principal machinery exporting country. To demonstrate the increased prosperity of the industry the financial results of groups of companies were quoted; twenty-seven electrical equipment concerns were said to have increased their profits by 85.4 per cent. in 1934-35 as compared with the preceding year. Future prospects were held to be bright. Mr. A. Ramsay, O.B.E., the director of the Engineering Employers' Federation, promised that the statement would be circulated to Federation members and the conference was adjourned until a date to be agreed between the parties.

Wages in the Cable-making Industry

At a meeting of the Joint Industrial Council for the Electrical Cable-making Industry held on February 26th it was agreed to raise the wages of male time workers, twenty-one years of age and over, in Districts Nos. 1 and 2. The new rates, which will come into force on the third pay-day in March, are equivalent to an increase of 1s. 11½d. for a 47-hour week in District No. 1, and 2s. per week in District No. 2. The wages of other time-workers and the wages of piece-workers are unaffected.

A New Distributing Organisation

The "Axia Six" exhaust fan, the American "Servel" refrigerators, and the "1900" washing machines, convection type heaters, and air-conditioning apparatus, are among a number of electrical products, of which Utilities (London), Ltd., Walton House, 1, Newman Street, London, W.1, are now sole distributors in this country. A full description of the "Axia Six" fan appeared in our issue of November 11th (page 715), its principal features being its silent operation, easy method of fixing on either wall or window, and all-bakelite weatherproof construction. The new company proposes to co-operate closely with electricity supply authorities and electrical contractors and retailers.

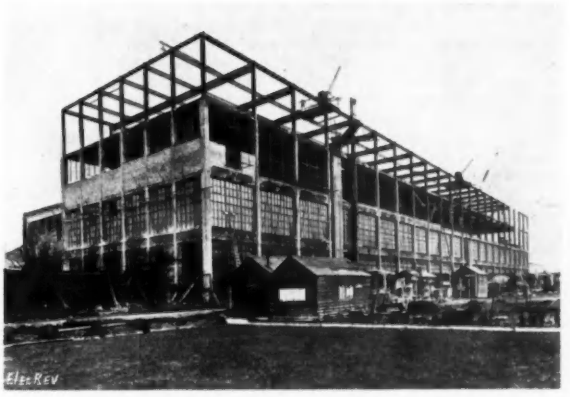
Radio Wholesalers' Dinner

The first annual dinner of the Radio Wholesalers' Federation was held at the Savoy Hotel, W.C., on February 26th, Mr. A. G. Beaver (president) presiding. The toast of the Federation was proposed by Sir Stephen Tallents, Controller (Public Relations), B.B.C., who said that the Radio Wholesalers' Federation had much already to its credit. Founded at a time when the trade was suffering from the "growing pains" which new industries experienced, it had brought together a band of responsible wholesalers, who had made a stand for fair dealing alike with manufacturers and retailers. It had set itself to secure that good articles were available in the right quantity, at the right time, in the right places and at the right price. It had owed much to Mr. E. H. Houghton, its president for the first seven years of its life. Its new president, Mr. Beaver, was a worthy successor to Mr. Houghton. Much credit was also due to the secretary, Mr. J. Macfarlane. There were days of great promise and some difficulty ahead alike in sound broadcasting and in television. The willingness of the trade to work with the B.B.C. was a good omen for the future. He would try in his new B.B.C. post to work with the radio manufacturing and distributing trades to the full.

Mr. Beaver, who responded, thanked Sir Stephen for his optimistic view of the future of the radio trade. He referred to the B.B.C.'s monopoly of broadcasting and said the members of their Federation would like to be monopolists in their particular sphere. He did not favour the tendency to produce lower-priced sets and made a plea for stability in design. It would be helpful if manufacturers would give three months' notice of their intention to withdraw listed models. He referred to the assistance which wholesalers had given manufacturers and said that wholesalers had been found the best and cheapest medium of distribution. Wholesalers would be prepared to discuss lower discounts, but it was essential that there should be a more stable and secure market. With regard to hire-purchase agreements he thought that some scheme of control would have to be introduced.

Strowger Works Extensions

Extensions are in progress at the Strowger Works, Liverpool, of the Automatic Electric Co., Ltd. The accompanying illustration shows the new building which is being erected



The new building at the Strowger Works of the Automatic Electric Co., Ltd.

and gives some idea of the nature of the extension which will result in 50,000 sq. ft. of additional floor space being available.

Swedish Electrical Trade

During 1935 Sweden's electrical imports increased by twenty-four per cent. in the case of classifications reckoned by value and twenty per cent. where weight only is recorded. Exports rose by six and thirteen per cent., respectively.

IMPORTS.		1935.	Inc. or dec. compared with 1934.
Generators, motors and convertors	...	£284,450	+ £77,650
Stators and rotors	...	36,500	− 2,200
Fans and vacuum cleaners	...	152,150	+ 44,350
Accumulators	...	35,900	− 10,600
Radio apparatus	...	675,800	+ 141,200
Other electrical apparatus ...	...	224,450	+ 1,550
Meters and other instruments ...	...	118,300	+ 47,550
Total	...	£1,527,550	+ £299,500
Dry cells	...	(tons) 842	+ 81
Incandescent lamps	...	62	+ 13
Flash lamps	...	267	+ 74
Electric carbons	...	3,844	+ 361
Switchgear, etc.	...	1,245	+ 293
Porcelain insulators	...	629	+ 200
Lead-covered cables	...	2,743	+ 385
Insulated wire	...	811	+ 317
Total	...	(tons) 10,443	+ 1,724
EXPORTS.			
Generators, motors and convertors	...	£606,550	+ £58,800
Stators and rotors	...	238,000	+ 8,500
Fans and vacuum cleaners	...	407,950	+ 44,850
Accumulators	...	55,500	+ 20,650
Telephone and telegraph apparatus	...	248,450	− 54,950
Radio sets and parts	...	64,050	− 2,350
Other electrical apparatus ...	...	113,500	+ 17,250
Total	...	£1,734,000	+ £92,750
Lead-covered cable		(tons) 1,564	+ 366
Switchgear, etc.	...	913	− 77
Incandescent lamps	...	59	− 4
Total	...	(tons) 2,536	+ 285

E.D.A. Luncheons

The annual luncheon of the South-Western and South Wales (Northern) Area of the British Electrical Development Association was held at the King's Head Hotel, Newport, on February 26th, the chairman of the branch, Mr. A. Nichols Moore, presiding. The toast of "The Association and the Local Executive Committee" was moved by Sir Robert Webber, J.P., who referred to the increased output of electricity during 1935, and said he looked forward to the day when it would be available to all at a flat rate of 1d. per kWh, and recommended that the local E.D.A. Committee should make a survey as to whether the electrification of the local railways would not be a good thing for the industry and for South Wales. Mr. P. J. Robinson, chairman of the E.D.A. Council, responded, and said that he believed the progress they had made during a period when practically every other industry had been depressed was due to the fact that people recognised that the application of electricity was a factor leading to improved health of the com-

munity. Some credit was due to E.D.A. also, but he regretted that although the industry was capitalised at more than five hundred million pounds only £50,000 a year was spent on propaganda and advertising. He said that we should consider the greater use of electricity in running our transport systems, particularly as regarded trolley-bus development. Mr. A. Nichols Moore also responded for the Committee and referred to the large number of local authorities still not members of the E.D.A. Other speakers were the Mayor of Newport (Councillor W. Casey), Mr. J. T. H. Legge, the Deputy Lord Mayor of Cardiff, and Mr. E. J. Dowson (area officer).

The need for greater Press advertising and the cheapening of electricity to increase the demand was stressed on February 27th at the annual luncheon at Newcastle-on-Tyne of the Northern Counties Area of the Association. Mr. S. G. Pike, the newly elected chairman of tbe branch, presided, and others present included the Lord Mayor of Newcastle (Ald. W. Locke), Sir John R. Brooke, C.B. (vice-chairman of the Electricity Commissioners), Mr. A. C. Cramb (director and secretary, E.D.A.), Mr. F. C. Winfield (chairman, N.E. Centre, I.E.E.), Mr. H. A. Couves (North-Eastern Electric Supply Co.), and many others, including electrical engineers from municipal authorities and representatives of electrical concerns in the area. Sir John Brooke, who proposed the toast of the Association, said that the industry had passed through the stage of parochial development, and the only way to establish the habit of industrial power and efficiency was by putting the industry on a national basis. The supply industry had made rapid progress during the last few years, but nevertheless there was still only half the industrial life of the country using electricity, and there was consequently still wide scope for development. Mr. A. C. Cramb, in reply, said that advertising meant spending large sums of money. They were, however, only spending about £50,000 per annum in the electricity supply industry, although £500,000,000 capital was invested in it. It was fatal to advertise in too many papers with announcements at infrequent intervals because the whole effect was lost during those intervals. Mr. S. G. Pike asked for the co-operation of manufacturers, wholesalers, contractors, and members of the I.E.E., with the E.D.A., to make the North-East Coast an electrified area.

The supply industry was criticised by the Mayor of Carlisle (Ald. J. R. Potts), who said it had failed miserably in carrying out its function of securing widespread distribution. A more direct and progressive policy was needed. Mr. F. C. Winfield (I.E.E.) replied to the toast of "The Guests," and expressed the opinion that the industry was starting at the wrong end in its development. Far too much emphasis was being laid on domestic electrical development which could never use more than a fraction of the output. If domestic electricity was to be cheap it must be carried on the back of a sound main industrial supply.

A New Kind of Display

The accompanying illustration shows a novel display, recently exhibited in the window of the Wimbledon Corporation Electricity Department's new showroom. It consists of a steel base with illuminated glass panels. The "Mazda" light tubes of various colours forming the upper portion of the display are duplicated on the two sides, and are supported by a light stainless steel framework. A model of the Mazda "Dancing Girl" slowly revolves in the centre. This display was designed in this form so that it could be used in an open window without obstructing the view into the showroom.

A "Mazda" display at the Wimbledon Electricity Department's Showrooms

The Batti-Wallahs

Reminiscences of his life in India and his journalistic career were given by Mr. R. J. Minney, author of the well-known play "Clive of India," when speaking as principal guest at the Batti-Wallahs' Society luncheon held on February 27th at the Hotel Metropole, London, W.C.2. A vote of thanks was proposed by Lt.-Col. W. A. Vignoles. The chair was taken by Sir Montague Hughman. The annual dinner and dance of the Society is to be held at the Hotel Metropole on Friday, March 20th.

Attendance at the Fair

According to an official statement issued at the close of the British Industries Fair last week, 148,783 people visited Castle Bromwich this year, an increase of 28,364 upon last year's figure.

An Electrical Refrigerator Exhibition

A comprehensive display of domestic and commercial refrigerators and air conditioning units, together with the application thereto of Delco electric motors, was given recently by Messrs. Delco-Remy & Hyatt, Ltd., who claim to be the largest manufacturers of small motors in the world and to have supplied over 10,000 condenser start motors for driving refrigerators in Great Britain. There was a representative selection of ⅛ to 10-h.p. motors of the condenser start, repulsion induction and high torque polyphase types with resilient mountings and automatic belt tensioning devices. A standard ½-h.p. motor, with tropical insulation, was run completely submerged in ordinary tap water. Radio interference suppression and overload capacity tests were also demonstrated.

The refrigeration plant which was exhibited included products of the Pressed Steel Co., Ltd., H.M.V. Household Appliances, Frigidaire, Ltd., Marco Refrigerators, Ltd., Savoy Refrigerators, Ltd., Kelvinator, Ltd., Sparton Refrigeration Co., Ltd., Searsint, Ltd., A. J. Balcombe, Ltd., and Zerozone, Ltd. Last year, the company states, over a million Delco motors were manufactured. Of these 75 per cent. were for refrigeration, 60 per cent. being of the condenser start type.

E.L.M.A. Activities

A two-day conference on the electric lighting of works and offices will be held at the E.L.M.A. Lighting Service Bureau on May 19th and 20th, when it is expected that the works managers and executives of many large works and offices will be present. Air Vice-Marshal Sir David Munro, secretary to the Industrial Health Research Board, will be present on the opening day to open the discussion on Mr. W. J. Jones's lecture on "The Science of Seeing." This will be followed by a lecture on the scientific control of light flux in which the characteristics of various fittings will be described together with the factors involved in design and examples of their applications. The afternoon lecture will include one by Mr. J. W. Howell, in which he will trace the connection between illumination and output in industry. The discussion will be opened by H.M. Chief Inspector of Factories, Dr. R. Wilson. The day will be concluded by a visit to a well-lighted factory in the vicinity. The second day of the conference will deal with lamp characteristics, the planning of lighting installations, the lighting of commercial buildings, and special lighting problems.

A new edition of the handbook "Architectural Lighting" has been issued by the Lighting Service Bureau. The book has been completely revised and its scope widened. Nearly all the pictures depicting installations are new and they show the great advance that has been made in lighting during a comparatively short space of time. A wider use has been made of diagrams, charts and new data for the information of the architect. The handbook covers every aspect of lighting that the architect may have in mind. This edition is the first of the series of new and revised publications that the Bureau is planning to bring out this year.

A tour of Southern Scotland, occupying three months, has just been completed by the E.L.M.A. touring demonstration van and its staff. The tour was inaugurated on October 3rd at Hamilton and continued until December 20th when the final demonstration lecture was given in the Scoonie Kirk Hall, Leven, Fifeshire. The services of the van were utilised by nine supply authorities serving about 3,500 square miles. The future programme of the touring demonstration is: March 10th-12th, Middlesbrough; March 16th and 17th, Durham; March 23rd and 24th, Chester-le-Street; March 19th and 20th, Houghton-le-Spring; March 26th and 27th, Hexham; March 30th and 31st, Workington.

Swedish Duty on Fuses

The Swedish Government has rejected a request that the duty on fuses or alternatively on porcelain for fuses should be lowered. The request was refused on the ground that several new Swedish firms had taken up production of fuses, supplies of which were hitherto imported from abroad. It is further pointed out that this new industry had so far been of advantage to the country, as competition from home-made goods had forced prices of German fuses down by nearly 30 per cent. For reasons of national economy the Government is thus interested in protecting the fuse industry.

Chilean Duty on Conduit

The duty on electrical conduit tubing imported into Chile has recently been increased from 0.15 to 0.40 gold peso per gross kg

French Radio Imports and Exports

A return lately to hand shows that the imports of radio receiving sets and apparatus, excluding valves, into France during the nine months ended with September last attained a value, taking francs at 75 to the £, of £406,620, as compared with £584,325 in the corresponding nine months of 1934. There was a slight increase during the corresponding period of

the exports of similar material from France, from £182,585 to £189,200.

Electricity v. Gas at Hythe

At its last week's meeting the Hythe (Kent) Town Council considered an offer by the Folkestone Electricity Supply Co., Ltd., to lay a cable to an estate of forty Council houses now in course of erection between Hythe and Dymchurch. It was mentioned that the Council had already made an agreement with the local gas company whereby the houses would receive a gas supply, and it was also said that the electricity company had previously stated that it could give the Council no hope of extending its supply to the houses. One councillor suggested that before the electricity company was given permission to lay the cable the gas company should be allowed to reconsider its terms, but the Mayor said that the company had refused to do this. Another member said that the Council had no right to prevent the tenants from taking a supply of electricity if they wanted it. Ultimately the matter was referred to the Buildings Committee, it being agreed that in the meantime the electricity company should be permitted to lay the cable.

A Rubber Handbook

The 1936 edition of "Rubber Producing Companies," compiled by the Mincing Lane Tea and Rubber Share Brokers' Association, Ltd. (*Financial Times*, Ltd., 7s. 6d.), is similar to preceding editions, containing information concerning the capital, acreage, latest accounts, dividends, &c., of rubber companies. A new feature is the capital per acre, which is shown for every company and helps to compare one company with another by bringing them to a common basis. Alphabetical lists of secretaries and directors are given, while companies with tea interests are also included.

A Plumber and his Association

An action of interest to contractors in which A. S. Smith, plumber, 185, King Street, Aberdeen, sued the Aberdeen and District Master Plumbers' Association for £2,550 for damages to goodwill and loss of business was heard last week by Sheriff Dallas. The case arose out of a refusal of one of the plaintiff's customers to pay certain charges. A Court action was raised, the plaintiff suing the customer, but the action was withdrawn, the Association not being prepared to give evidence that the price-list charges made by the plaintiff were correct. Plaintiff maintained that the charges were in accordance with the only then existing price-list. He had, he averred, suffered damage to the goodwill of his business through the action being withdrawn, which was reasonably estimated at £1,600, and the Association's action in having caused him to be struck off the list of the Aberdeen Corporation plumbers had caused him serious loss and damage, which he estimated at £900. He asked the Court to find that the action of the Association in preventing him from obtaining supplies from wholesale firms was illegal, and to order the respondents to withdraw the instructions to refuse to supply.

It was not a simple matter to discover from plaintiff's somewhat vague statements, said Sheriff Dallas, what the exact injury or wrong plaintiff founded on was, but it was clear from his first plea that his claim for damages was for the respondents' failure to support him when obeying the rules of the Association. His Lordship was accordingly of the opinion that the plaintiff's claims were excluded from the jurisdiction of the Court in the terms of Section 4 of the Trades Disputes Act, 1906. He accordingly dismissed the action and found plaintiff liable in expenses on the higher scale.

Irish Free State Electrical Imports

The appended table shows the values of the imports of electrical machinery and allied material into the Irish Free State during January last as compared with the corresponding month of 1935. As will be seen, the month was a fairly active one, the imports showing an increase of £12,349 :—

	January, 1935.	January, 1936.
Electric motors	£2,247	£4,291
Other electrical machinery	16,839	16,417
Dry batteries	1,619	1,172
Electric lamps	4,655	5,414
Electric lighting accessories, fittings and parts	5,890	7,590
Electric wires and cables, insulated	6,541	7,721
Telegraph and telephone apparatus	395	356
Radio receivers (complete)	8,280	5,651
Radio gramophones (complete)	399	58
Radio receivers, partly assembled	1,405	576
Radio parts and accessories	6,829	6,037
Other electrical goods	16,442	28,607
Total	£71,541	£83,890

Preston Electrical Exhibition

An electrical exhibition arranged by the Preston Corporation Electricity Department will be opened on March 9th by Sir John R. Brooke at the Public Hall, Preston.

Trade Announcements

Messrs. Watsham's, Ltd., have removed to Horseferry House, Westminster, S.W.1 (Telephone : Victoria 2328-9).

The Northern Steel & Hardware Co., Ltd., has been appointed sole distributor for Zeros (Ismay) refrigerators, for the counties of Lancashire and Cheshire, North Wales and the Isle of Man, excluding certain area.

Social Events

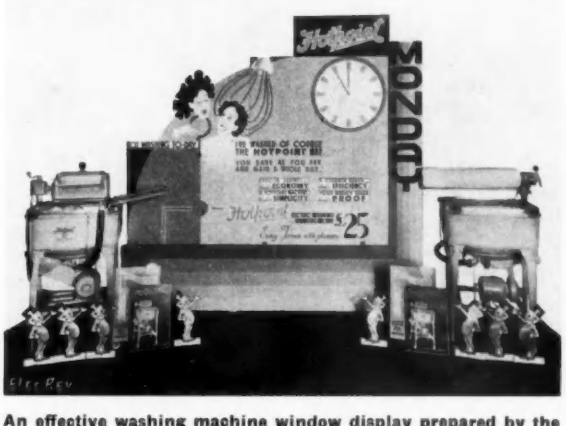
On February 21st the Vacuum Cleaner Department of the Nottingham Branch of the Hotpoint Electric Appliance Co., Ltd., held its annual dinner at the Welbeck Hotel, Nottingham. The chair was taken by Mr. J. H. Ratcliffe, manager of the Department. Among those present were Mr. O. H. Buckingham, general manager of the company, Mr. R. L. Bradford, Southern area vacuum cleaner manager, and Mr. A. T. Hulance, Nottingham branch manager.

The G.E.C. Dramatic Society is giving its annual performances in aid of the Infants' Hospital, Westminster, on March 30th and 31st at the Fortune Theatre. The piece chosen is "Nightie Night," a farce. Applications for tickets should be made to Miss Burroughs, Magnet House, Kingsway, W.C.

The annual carnival organised by the Stafford Works Social and Athletic Club of the English Electric Co., Ltd., was held from February 24th to 29th inclusive, large numbers of employés and their friends being entertained each evening. For those who did not dance there was a whist drive on each night. The hall was extended last year and so successful has this annual function become that it was filled to capacity each evening. It is estimated that approximately 4,000 people were entertained during the week. The functions were well supported by members of the management and executive staffs, including Mr. J. Bissett (general manager of works), Mr. C. Hollander (commercial manager), Mr. A. M. Pooley (manager, Fusegear Department), Mr. J. H. Wears (chief superintendent, Stafford Works), and many others. Mrs. G. H. Nelson, wife of the chairman and managing director, was present on several occasions and presented the prizes for the "spot" dances and whist on Monday evening. Similar prizes were presented on the respective evenings throughout the week by Mrs. J. H. Wears, Mrs. A. G. Brown, Mrs. A. T. Chadwick, Mrs. J. Bissett and Mrs. A. M. Pooley. The Mayor of Stafford (Alderman H. G. Owen) and the Deputy Mayor (Councillor S. Robinson) were also present on several evenings.

A Tyneside Electrical Scheme

The West Hartlepool Corporation Electricity Committee has had under consideration, but has as yet reached no decision upon, a proposal that the Town and Factory Development Association should supply electricity to the Corporation and



An effective washing machine window display prepared by the Hotpoint Electric Appliance Co., Ltd., which will shortly be available to the trade

that the profits, it is understood, should be shared equally between the Association and the Council. The scheme is similar to that being promoted at Worksop (Nottinghamshire) which is receiving the attention of the Electricity Commissioners. At West Hartlepool the Town Council has a contract with the North-Eastern Electric Supply Co., Ltd., to supply electricity until 1939, and it is suggested that this contract should not be renewed but that the Town and Factory Development Association should supply electricity. If the scheme is adopted a generating station will be built to supply neighbouring factories and any new works built by the Association.

German Radio Exports

The value of exports of radio apparatus from Germany declined from 11.1 million Reichsmarks in the first half of 1934 to 9.3 millions in the corresponding period of 1935. In the seven months ended with January, 1936, however, exports reached 19.8 million marks as against 17.5 millions.

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, March 4th :—No change in the price of copper bars (best selected), sheet and rod and English pig lead. Spelter, £16, 5s. increase. English block tin £209 5s., £1 15s. increase.

Messrs. Frederick Smith & Co. report, March 4th :—Electrolytic copper bars, £40 5s., 5s. decrease. Ditto, ditto, wire rods, £46 5s., 5s. decrease. Ditto, ditto, h.c. wire, 7 7/8d., 1/8d. decrease. Silicium bronze wire, 8½d., 1/8d. decrease.

Messrs. Edward Till & Co. report, March 4th :—No change in the price of India rubber, Para fine.

A Disclaimer

The Home Secretary was asked in the House of Commons last week if he was aware that electrical terminals had been assembled in prisons for Messrs. Gilson & Co., Ltd. In the advertisement pages of this issue Messrs. Gilson strongly refute this suggestion.

Exhibition of Women's Progress

To demonstrate the remarkable expansion of women's activities during the past twenty-five years an interesting exhibition is now being held at Sunderland House, Curzon Street, London, W.1. The valuable work done by women in promoting "electrical-mindedness" in the home is indicated by the Electrical Association for Women, the feature of whose attractive stand is a pair of paintings depicting kitchens of yesterday and to-day, with the slogan "She Stoops to Conquer" above. Panels and photographs point out the aims and scope of the Association. A display of special glass lighting fittings is to be seen on the stand of the Electric Super Service Co., Ltd., of which Mrs. Pender Chalmers is a director. The "Holdaphone," a woman's invention for leaving both hands free when using the telephone, is shown by C.D. Inventions. The exhibition, the proceeds of which are to be given to the Marie Curie Hospital, will remain open until March 21st.

New Catalogues and Lists

"Diamond H" Switches, Ltd., Gunnersbury Avenue, London, W.4.—A brochure entitled "Control Power with a Certainty," containing information relating to "Diamond H" switches and thermostats.

British Insulated Cables, Ltd., Prescot.—A leaflet dealing with enamelled wire with treated paper lapping and a booklet on magnetic moulding machines.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlet No. 730 dealing with improved ring-main tee-off isolators, and No. 976 describing Holmes class "L" induction motors.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—A leaflet describing new lamps for seasonal decorations.

English Electric Co., Ltd., Stafford.—A number of new publications dealing with cookers, fuse gear, industrial motors, and back pressure turbines.

Latis Glass Co., Ltd., Brettenham House, Wellington Street, London, W.C.1.—A leaflet describing an attractive form of glass screening.

Anglo-Swiss Electrical Co., Ltd., 15, Victoria Street, London, S.W.1.—Details of the Trüb, Taüber small electrostatic voltmeter.

Lancashire Dynamo & Crypto, Ltd., Trafford Park, Manchester.—A review of the operation of the company during 1935.

Clarkes (Redditch), Ltd., Sinew Works, Redditch.—A complete catalogue of the many types of "Sinew" springs available.

J. G. Statter & Co., Ltd., 82, Victoria Street, London, S.W.1.—A catalogue (No. 203) of air-break circuit-breakers.

Bylock Electric, Ltd., 109, South Street, Ponders End.—A leaflet illustrating a new electric hair dryer.

General Radiological & Surgical Apparatus Co., Ltd., 204, Great Portland Street, London, W.1.—A booklet describing, with full technical details, the Siemens-Pantix shockproof rotating anode tubes.

Brook Motors, Ltd., Huddersfield.—A complete catalogue of surface cooled motors and a pocket stock list of motors.

Gent & Co., Ltd., Faraday Works, Leicester.—Catalogue No. 1G dealing with electric bells, indicators, relays, pushes, audible and visible signal systems, batteries and sundries.

Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.4.—A booklet on electrically driven air washers.

G. E. Marbaix, Ltd., Vincent House, Vincent Square, London, S.W.1.—Descriptive matter relating to the "Haskins" electrically operated machines for applying screws and nuts.

Universal Services, 148, High Holborn, London, W.C.2.—Literature dealing with the installation of radio and television equipment in modern buildings.

Bankruptcy Proceedings

Rebecca A. Robinson, radio and electrical engineer, 287, Upper Street, Islington, trading as the Highbury Engineering Works.—The statutory first meeting of creditors was held on March 2nd at London Bankruptcy Buildings, when a statement of affairs was submitted showing liabilities of £533 against assets £189. The debtor stated that she began business in 1921 at 62, Holloway Road, and in 1925 opened a branch at 287, Upper Street. The Holloway Road business was handed over to her son in 1928. The business had fallen away during the past twelve months owing chiefly to increased competition by price-cutting firms. Then bad debts were contracted due to defaulters under hire-purchase agreements. Recently a judgment creditor levied execution, whereupon she filed her petition. The case was left in the hands of the Official Receiver.

W. A. Prince and **C. S. Prince,** trading as Prince Bros., electrical contractors, 69, Princess Street, Manchester.—A receiving order was made recently on the debtors' own petition. Their statement of affairs shows gross liabilities of £2,171, of which £2,140 is expected to rank for dividend, with net assets of £653, leaving a deficiency of £1,487. The debtors attribute their failure to losses on contract work and bad debts. At the first meeting of creditors Mr. A. T. Eaves, of Messrs. Harry L. Price & Co., 47, Mosley Street, Manchester, was appointed trustee of the estate with a committee of inspection.

N. A. Peters, 192, Robin Hood Lane, Hall Green, Birmingham, electrical and wireless engineer.—The public examination of the above debtor was held on February 26th at the Court House, Corporation Street, Birmingham. According to the statement of affairs there were gross liabilities of £286 and a deficiency of £212. Debtor attributed his failure to lack of capital and heavy establishment expenses. The examination was provisionally closed.

H. Barker, radio dealer, 53, Cambridge Street, Camberwell, S.E.5, late of Torquay.—First meeting March 6th at Exeter Bank Chambers, Broadgate, Exeter. Public examination March 26th at the County Court Offices, Torquay.

C. Worden, electrical engineer and radio dealer, 89, Duckworth Street, Darwen.—Trustee, Mr. H. S. Haworth, 7, Lord Street West, Blackburn, Official Receiver, released February 19th.

L. L. Morgan, radio and electrical engineer, 7, High Street, Purley, Surrey.—First and final dividend of 5d. in the £, payable February 28th at 29, Russell Square, W.C.

C. R. Miskin (Miskin & Rice), electrical contractor, Bush House, Aldwych, W.C.—Receiving order made February 22nd on debtor's own petition. Public examination April 3rd at Bankruptcy Buildings, Carey Street, W.C.

R. Field, electrical engineer, 61, Drewton Street and 156, Westgate, Bradford.—Receiving order made February 22nd on debtor's own petition.

F. Pyle (F. & E. Pyle), wireless engineer, Station Road, Okehampton.—Receiving order made February 20th on debtor's own petition.

W. Hodge, electrical engineer, 3, Saltash Street, Plymouth.—Last day for receiving proofs for dividend March 10th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

Company Liquidations

Rhymos, Ltd., electrical engineers, Mayes Road, Wood Green, London, N.—The statutory meeting of creditors of the above was held on February 21st at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, London, E.C. The statement of affairs showed ranking liabilities of £3,191. The assets comprised book debts, £88; work in progress, £624; stock, £406; sign stock, £190; motor cycles, £25; and furniture and fittings, £45. The issued capital of the company was £3,257, and as regarded the shareholders there was a deficiency of £5,070. It was reported that the company was registered in September, 1932, with a nominal capital of £4,000. The present position was attributed to losses on the trading. Resolutions were passed confirming the voluntary liquidation of the company with Mr. W. A. J. Osborne as liquidator, and a committee consisting of the representatives of Messrs. Falk, Stadelmann & Co., Liverpool Electric Co. and National Electrical Supplies, Ltd.

Allwave International Radio and Television, Ltd., Bromley, Kent.—The statutory meeting of the creditors of the above was held recently at the offices of Messrs. C. Latham & Co., accountants, 185/8, High Holborn, London, W.C. The statement of affairs showed ranking liabilities of £2,496 and net assets of £95, with a deficiency, as regarded the creditors, of £2,401. The company was registered in May, 1934, with a nominal capital of £1,500. All the capital had been issued, and £1,300 was subscribed for in cash. The largest shareholder was the loan creditor who had also guaranteed the bank overdraft. The position of the company was attributed to the low sales effected, losses incurred on the trading, and the inability to obtain further working capital. The creditors passed a resolution confirming the voluntary liquidation of the company with Mr. C. Latham as liquidator.

Bawtree Williams, Ltd., radio and electrical dealers, Regent Buildings, London Road, Portsmouth.—The creditors of the above met on February 21st at the George Hotel, High Street, Portsmouth. The statement of affairs showed ranking liabilities of £1,189, all due to the trade. After allowing £115 for preferential claims the net assets were £538, with a deficiency, so far as the creditors were concerned, of £681. The company was registered in July, 1932, and had incurred losses since that date. A distraint had been levied by the landlord. Resolutions were passed confirming the voluntary liquidation of the company with Mr. C. H. J. Jones, of Commercial Road, Portsmouth, as liquidator, with a committee consisting of the representatives of Itonia, Ltd., Pye Radio, Ltd., and Wall & Attwooll, Ltd.

Telsen Electric Co., Ltd., wireless and electrical manufacturers, Birmingham.—The liquidator, Mr. C. Latham, 185-188, High Holborn, W.C.1, has informed the creditors of the company that a settlement has been reached in the matter of the claims against three former directors by which a sum of £12,500 has been paid to him and all claims against the company by Mr. Macnamara have been withdrawn. A claim for income tax amounting to £5,912 has been successfully disputed. Several debts have yet to be collected. It is estimated that the amount of claims which will rank for dividend will be about £106,000. A first dividend of 4s. is being paid.

Webb & Goward, Ltd.—Winding up voluntarily. Joint liquidators, Mr. K. S. Peirson, 16-17, Hertford Street, Coventry, and Mr. A. Willmott, 73, Cheapside, E.C.2.

Coatbridge & Airdrie Electric Supply Co., Ltd.—Particulars of claims by March 10th to Mr. I. R. G. Jones, solicitor for the liquidator, 46-47, New Broad Street, E.C.2.

Cawley's Wireless Service, Ltd.—Winding up voluntarily. Liquidator, Mr. P. W. Ardran, 41, Castle Street, Liverpool.

Chiswick Electricity Supply Corporation, Ltd.—Winding up voluntarily. Liquidator, Mr. O. W. Williams, 79, Salisbury House, London Wall, E.C.

Joubert & Wright, Ltd.—Meetings March 25th at 6, Weston Park, Kingston-on-Thames, to receive an account of the winding up by the liquidator, Mr. A. H. Austin.

Brynland Electrical & Radio Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. Collins, 28, Baldwin Street, Bristol.

Electric Lamp Factors, Ltd.—Meeting March 30th at 11, Ironmonger Lane, E.C., to receive an account of the winding-up by the joint liquidators, Messrs. W. H. Peat and L. Civval.

Private Arrangement

E. G. Pulford, junior, electrical and radio engineer, 83, Seaview Road, Wallasey.—At a recent meeting of creditors at the offices of Mr. P. S. Booth, 2, Bixteth Street, Liverpool, a statement of affairs was submitted which showed liabilities of £1,659 and net assets of £373, leaving a deficiency of £1,286. It was decided that the matter should be dealt with under a deed of assignment to Mr. Booth, whilst a committee was also appointed.

Dissolutions of Partnership

F. J. Gammon and **W. L. Pope,** electrical engineers and contractors, 131, Ley Street, Ilford.—Messrs. W. L. Pope and F. J. Gammon have dissolved partnership. Mr. Gammon will attend to debts and carry on the business.

A. E. Chapman & Co., electrical engineers, 113, Reddal Hill Road, Old Hill, Staffs.—Messrs. A. E. Chapman and T. Coley have dissolved partnership, so far as concerns Mr. Coley, who has retired from the firm.

Electricity Supply

Lighting, Domestic, Power

Alderley Edge and Wilmslow.—LOWER CHARGES.—The Joint Electricity Board has reduced the summer charge for cooking, water heating and on the all-in tariff to ½d. per kWh.

Barnstaple.—LOANS.—The Corporation has applied for loans of £3,000 for mains and services and £3,000 for meters.

STREET LIGHTING.—A scheme of public lighting by electricity in the Derby area has been adopted.

Birkenhead.—BULK SUPPLIES TO PORT SUNLIGHT AND BROMBOROUGH.—In connection with the provision of bulk supplies of electricity to the estates of Messrs. Lever Bros., Ltd., at Port Sunlight and Bromborough, the C.E.B. has submitted to the Electricity Committee an estimate of £93,452 as the cost of mains and plant. Application is to be made for permission to borrow this amount.

Blackburn.—REDUCED FLAT RATE.—A reduction in the flat rate from 6d. to 5d. per kWh as from June 30th is recommended by the Electricity Committee.

Chelmsford.—ELECTRICITY FOR BOREHAM.—The Rural District Council has been informed by the County of London Electric Supply Co., Ltd., that it is hoped to have a supply of electricity available at Boreham by the end of September.

Cheltenham.—SUPPLY TO WOODMANCOTE.—Permission is being sought by the Electricity Committee to provide a supply of electricity to Woodmancote by overhead lines.

Chester.—MORE "HISTORICAL ATTRACTIONS" DISPLAYS.—The "Historical Attractions" display, held for the first time last year, aroused sufficient interest to justify an extension of the scheme during the coming season, and it has been decided to hold displays from March 21st to April 21st, during the Cheshire Agricultural Show (September 3rd, 4th and 5th) and from September 12th to October 17th. Publicity matter includes a poster portraying a Roman soldier, with Chester Castle in the background. There will be floodlighting of the city walls, gates, towers, the cathedral, churches, public parks, historic houses and buildings, and the illumination of the coats of arms of twenty-five city guilds. The colourful lighting of the banks and bridges of the River Dee will again be a prominent feature, while trips in illuminated motor boats are being arranged.

Chesterfield.—BULK SUPPLY TERMS.—Terms upon which the Derbyshire & Nottinghamshire Electric Power Co. would be prepared to give a partial bulk supply of electricity to Chesterfield are now being considered by the Town Council.

Congleton.—ELECTRICAL DEVELOPMENT.—Mr. R. Bell, engineer and manager of the electricity undertaking, informs us that a scheme for the electrical development of the West Heath area at a cost of £1,250 has been approved by the Town Council.

Cumberland.—REQUEST FOR SUPPLY.—Representatives of public bodies have approached the Carlisle Corporation with a view to securing a supply of electricity in the Brampton Fellside area.

Darlington.—REBATE ON ACCOUNTS.—The Town Council is granting a ten per cent. rebate on all electricity accounts for the current quarter.

Eastbourne.—OVERHEAD LINES.—The Minister of Transport has consented to the erection of overhead lines at Deudneys Farm, Magham Down; Highlands Farm, Arlington Road; Friday Street and Langley; Stone Cross, Westham and Mill Hill, Hankham.

COOKER RESTRICTION.—It is reported that the Buildings Committee will not agree to electric cookers being installed in rooms less than 9ft. in height and 70 sq. ft. in area.

Edinburgh.—CHEAPER STREET LIGHTING.—A reduction in the charge for electric lighting in streets and tenement stairways from the present flat rate of 0.95d. per kWh to the following scale has been approved by the Public Utilities Committee:—First three million kWh, 0.9d. per kWh; all in excess, 0.75d. per kWh.

Epsom and Ewell.—REFRIGERATORS.—The Urban District Council has decided to adopt a scheme for supplying electrical refrigerators on hire-purchase terms.

Finchley.—A TWO-PART TARIFF.—As the first step in a general scheme of price reduction, the Council has approved a recommendation of the Electricity Committee that a two-part alternative domestic tariff shall be introduced, based on 10 per cent. of the rateable value of the property concerned, plus ½d. per kWh.

France.—A NEW TRANSMISSION LINE.—The Société Hydro-electriques des Basses Pyrenées, of Bayonne, has been authorised to proceed with the erection of a 60 kV transmission line between the hydro-electric station at Banca and a steam-operated generating plant at Mouguerre, in the Lower Pyrenées. The new line is intended to take the place of a 30 kV one which has been in use for some years.

Garstang.—RURAL SUPPLIES.—The Lancaster Corporation is to apply for a Special Order to supply electricity in the parish of Forton and parts of Nether Wyresdale and Winmarleigh, in the area of the Garstang Rural District Council. The Preston Corporation has agreed to transfer this area to the Lancaster Corporation.

Germany.—INCREASING POPULARITY OF ELECTRIC COOKERS.—It is reported that considerable progress is being made in extending the use of electric cookers. Figures for 1934 show an increase of 51.4 per cent. over those for 1933, and it is said that during the first six months of 1935 there were as many new installations as during the whole of 1934. The greatest utilisation is by office employés and workmen, who account for 71 per cent of the installations.

HIGH-VOLTAGE CABLES.—In a recent issue of the *Electrotechnische Zeitschrift* Herr G. Schnaus quotes some interesting figures from a report issued by the German Electricity Supply Association regarding the types of conductors used in h.v. transmission systems in Germany. These show that 75 per cent. of the transmission lines have conductors of copper, while in 20 per cent. aluminium is used, the balance being made up of conductors of the aluminium alloy "Aldrey," steel and aluminium, and bronze and iron. The aluminium conductors are mainly used for the transmission of power at between 110 and 150 kV.

Glasgow.—FLOODLIGHTING THE LARGEST LINER.—Until May 27th, the date of its departure, the liner *Queen Mary* will be floodlighted at night.

Great Yarmouth.—LOAN FOR MAINS AND SERVICES.—The Town Council has received sanction to a loan of £43,000 for mains and services.

Horncastle.—TRADESMEN PREFER ELECTRIC LIGHTING.—A resolution asking the Urban District Council seriously to consider lighting the town by electricity instead of by the present gas lamps was passed at a recent meeting of Horncastle Tradesmen's Association.

Japan.—MORE HYDRO-ELECTRIC PLANS.—Although the Japanese Electric Power Federation has declined to sanction the construction of two big steam power stations at Nagoya, it has approved an expenditure of approximately 65,000,000 yen on the construction of ten hydro-electric stations in various parts of Japan. Within the past year projects for seven other power plants involving 250,000 kW have been approved for completion between November, 1937, and October, 1940.

Jarrow-on-Tyne.—ELECTRICITY EXTENSION.—The North-Eastern Electric Supply Co., Ltd., is to lay underground mains to serve houses on the Town Council's estate.

Keighley.—DEVELOPING ELECTRICITY SERVICES.—Considerable electrical development is indicated by the Electricity Committee's application for permission to borrow £63,000. This will be divided up between mains and services (£40,000), meters and time switches (£10,000), sub-station equipment (£10,000), and apparatus for hire (£3,000). The Committee also recommends that the electrical engineer shall be authorised to carry out, during the coming summer, a programme of laying new mains and increasing the capacity of existing mains at an estimated capital cost of £6,200.

Maldens and Coombe.—BY-PASS ROAD LIGHTING.—The Minister of Transport has written to the Urban District Council asking it to consider a proposal for floodlighting the Kingston by-pass road. The Council has agreed on condition that the Ministry and Surrey County Council contribute a substantial portion of the cost.

London.—SOUTHWARK.—The Electricity Committee is to undertake further "free" wiring installations at a cost of £465.

Lugar (Ayrshire).—SUPPLY INAUGURATED.—A supply of electricity to the village was inaugurated recently.

Manchester.—TRANSFORMER PLANT.—The transformer plant at Denton and Droylsden is to be extended by the Electricity Committee at a cost of £11,500.

LOANS.—The Electricity Committee has obtained sanction to borrow £15,000 for sub-stations and £30,000 for equipment.

Manchukuo.—EXTENSIVE ELECTRICAL DEVELOPMENT PLANS.—The Manchukuo Electricity Company is to spend 17,000,000 yen on electrical development works. A 14,000-kW steam power station is to be erected at Harbin, another of the same capacity at Hsinking and one of 5,000 kW at Kuoliukang. Part of the money will be devoted to the improvement and standardisation of the transmission lines in North Manchukuo. Other works projected in the country include the construction of a large hydro-electric station on the Sungari River.

Meriden (Warwickshire).—ELECTRICITY FOR COUNCIL HOUSES.—Acting upon a suggestion made by the Birmingham Electric Supply Department, the Rural District Council has decided to have its houses at Meer End, Balsall, wired for electricity in order to facilitate the supplying of other properties in that district. Other Council houses will be wired where electricity is available.

Middlesex.—HOSPITAL EQUIPMENT.—A shadowless lamp and a modern emergency lighting unit costing £400 and new X-ray equipment (£2,500) are to be provided by the Health Committee for the West Middlesex County Hospital.

Mogden (Middlesex).—SUPPLY TO WORKS.—The Heston and Isleworth Corporation has agreed to supply electricity at 1½d. per kWh to the Mogden purification works of the Middlesex County Council.

Morecambe.—NEW EQUIPMENT.—Sub-stations costing £4,715 and plant (£4,850) are to be provided by the Electricity Committee.

Mountain Ash.—CHEAP ELECTRICITY FOR LIGHTING.—For the third time in the current financial year Mr. E. W. Jones, electrical engineer to the Council, has announced concessions to consumers. The charges for lighting are to be lowered by ½d. per kWh to 2d. per kWh. Consumers will also receive the usual discount of ¼d. per kWh for prompt payment, making the net cost 1¼d. per kWh.

Northamptonshire.—RURAL ELECTRIFICATION PROGRESS.—In the area served by Northampton Electric Light and Power Co., Ltd., which covers over 1,000 square miles, supply mains are now within reach of 95 per cent. of the total population.

Parkstone Quay.—POWER STATION CLOSURE.—The London and North-Eastern Railway power station at Parkstone Quay was closed last month. Electricity for the Quay and Manningtree branch is now supplied by the Central Electricity Board.

Seaton Valley (Northumberland).—GAS PROPOSAL REJECTED.—A proposal to install gas for street lighting at Seghill has been rejected by the Urban District Council, and it has been decided to adhere to the present agreement with the Seghill Collieries, Ltd., for electric street lighting at 4d. per kWh.

Southend-on-Sea.—PRIVATE ILLUMINATIONS.—Electricity for illuminations of a decorative character on private buildings is to be supplied at 1d. per kWh.

Stoke-on-Trent.—SUPPLY EXTENSION.—Mains are to be extended by the Electricity Committee at a cost of £500 to provide a supply to 115 houses to be erected by Messrs. W. Leake & Co. on the Dairyfields Estate, Leek New Road, Sneyd Green. The Committee is also to extend mains at a cost of £975 to supply 172 Council houses at Leek Road, Hanley.

ASSISTED WIRING.—Sanction is being sought to a loan of £50,000 for assisted wiring.

SUB-STATIONS.—The Electricity Committee is to provide a sub-station in Drubbery Lane at a cost of £4,400 to improve the supply in the Blurton district, and it is to erect another in Thomas Street at a cost of £10,200.

Sunderland.—EXTENSION OF PLANT NOT APPROVED.—The Central Electricity Board has informed the Corporation that it is not prepared at present to agree to the Corporation's plans for extending the generating station, the construction of a new station, or the provision of a new water-cooling tower at a cost of £11,000. The Board suggests that there is sufficient plant in the area to supply Sunderland's needs, and proposes that the Corporation should purchase any additional energy needed from the grid.

Switzerland.—A TRAVELLING ELECTRIC POWER STATION.—In a recent issue of the *Bulletin* of the Association Suisse des Electriciens particulars are given of a travelling electric power station which has been put into service by the Zurich Electricity Department for the provision of emergency supplies. The power station is mounted on a 3½-ton petrol motor truck, the 95-h.p. engine of which is adapted for either driving the vehicle or for running a three-phase generator mounted at the rear of the chassis. The truck is also provided with a 100-kVA, 380/250-V transformer, a switchboard and two connecting-up cables. The outfit has been in use for about two years and is stated to have proved extremely useful and satisfactory.

Wallasey.—AUTUMN ILLUMINATIONS.—The Finance Committee has asked the Publicity Committee, together with representatives of the Electricity and Motor Bus Committees, to formulate a scheme of autumn illuminations.

Wareham and Purbeck (Dorset).—RURAL PLANS.—A meeting was held recently of a committee appointed by the Rural District Council and representatives of the Bournemouth and Poole Electricity Supply Co., Ltd., following complaints of slow progress in providing supplies to villages in the area. On behalf of the company it was stated that a supply would be available at Lytchett Matravers this summer. The extension would then be carried on to Morden, and it was hoped to have this section completed by July, 1937. Proposals had been passed for extensions to Wareham St. Martin and Church Knowle, while the provision of a supply to the western half of Lytchett Minster was contemplated. During 1935 the company laid 85 miles of mains in the district.

Weymouth.—SUPPLY TO BINCLEAVES.—Tenders are to be obtained for electrical equipment in connection with the provision of supply to the Vernon torpedo range, Bincleaves.

Willesden.—CO-OPERATION WITH ELECTRICAL CONTRACTORS.—Following a meeting between Willesden electrical contractors and the Electricity Committee, the latter has recommended to the Council that approved established electrical contractors in Willesden shall be granted facilities to enable them to effect sales, including hire-purchase sales, at the electricity showrooms, and that when such sales or hire-purchase agreements are entered into the contractors shall be granted a portion of the trade discount.

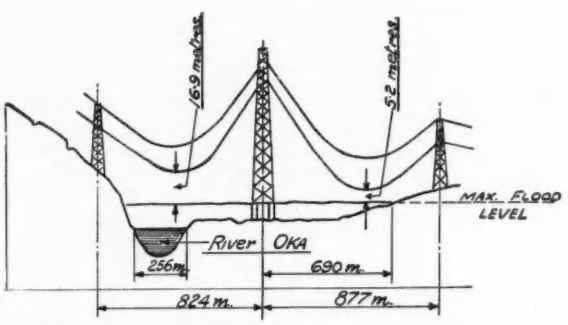
York.—CABLE EXTENSIONS.—The Electricity Committee is to extend cables at a cost of £5,776.

LOANS.—Sanction to borrow £6,000 for wiring installations and £35,000 for mains and services has been obtained by the Electricity Committee.

A Difficult River Crossing in Russia

A DETAILED description of the 220-kV transmission line crossing the River Oka is given in *Elektritschestwo*. The position chosen is about 4 km. from Kashira, and the crossing is part of the Stalingorsk-Moscow transmission line now under construction.

Among the many difficulties encountered in this undertaking was that of flooding. In the spring the River Oka floods to the extent of 1.5 km. and has a maximum depth of 10 m. Two schemes were considered, namely, (a) the erection of a single span of 1,700 metres crossing the river and flooded area and (b) the construction of a high intermediate tower and the use of two spans. Scheme (b) was ultimately adopted, partly on account of the fact that the waterside towers could be erected at a height of 7 m. above maximum flood level and in compact ground of known composition and, furthermore, it was necessary to provide a minimum clearance of 16 m. between the conductors and the normal level of the river to allow for navigation.



Profile of crossing showing the extent of the flooding of the River Oka

For the present the required capacity is 200,000 kW, and consideration was given to the possibility of duplicating the conductors on the single towers. This scheme was finally abandoned on account of the danger of the whole supply being affected by the failure of one line.

In calculating the towers and conductors the following values were used: Thickness of ice loading, 22 mm.; cross wind, 15 m. per second; factor of safety for all components of the line and structures, 3. The conductors are steel-cored bronze having a sectional area of 525 mm.², the stranding being as follows: Steel centre 27/3.2 mm. wires, diameter 19.7 mm.; 1st layer bronze 26/2.6 mm. wires, diameter 24.9 mm.; 2nd layer bronze 32/2.6 mm. wires, diameter 30.0 mm.: and total weight of conductors, 4,530 kg. per km. The span over the navigable part of the river is 824 m. and that over the flood land 877.6 m.; in the latter case the clearance between conductors and the maximum flood level is 5.2 m., which comfortably complies with the allowable minimum clearance of 4 m. for 220-kV lines.

The conductors are disposed in a horizontal plane 10 m. apart. Two steel earth screen conductors are fixed 7 m. above the line and in the span this is increased to a maximum of 13 m. due to the lower weight of the all-steel earth screen.

In order to facilitate the construction of the crossing it was decided to pass both the steel screens and the line conductors through rollers on the intermediate tower. Double suspension insulators type P.7 are used throughout and on the waterside angle towers special means are provided for securing the conductors so as to minimise oscillations. The towers are constructed from welded angle section steel varying from 120 by 120 by 12 mm. down to 35 by 35 by 5 mm.

The maximum stress in the tower structures is computed as 1,600 kg. per cm. during normal conditions, and 1,920 kg. per cm. upon the severance of a conductor. The intermediate tower has a total weight of 29,500 kg., including stairway and platform, and is carried on a foundation 8.75 m. above ground level and having a depth of 4.55 m. The foundation works consist of rubble concrete, faced with concrete above ground; 1,037 cu. m. of material was used in this foundation. The two waterside towers support the line at angles of 68 deg 32 ft. and 11 deg. 45 ft. respectively. In both cases the height from ground level to the insulator supports is 25 m. and to the protective earth screen 32 m. The combined weight of these two towers is 33,000 kg.

It is claimed that the River Oka crossing represents the most efficient scheme of its kind so far carried out in the U.S.S.R.

Traction

Manchester.—PROPOSED TUBE RAILWAY.—The City Council's resolution calling for the appointment of a special committee to consider the construction of a "tube" railway was considered by the Nomination Committee last week. No action was taken.

Northern Ireland.—BELFAST TROLLEY-BUS PROPOSAL.—A sub-committee of the Council has recommended that certain tramway routes should be replaced by trolley-bus services.

South Shields.—A NEW TRAMCAR.—The Brush Electrical Engineering Co., Ltd., has delivered to the Corporation a new type of streamlined tramcar which will be the first of its kind in South Shields. It has a wide central entrance with staircases leading to the upper deck.

Swansea.—BUSES TO REPLACE TRAMS.—The Borough Council has ratified the agreement regarding the town's passenger transport system, and, subject to Parliamentary sanction, the tramway system will be replaced by motor bus services by August, 1938.

United States.—LARGE ELECTRIFICATION SCHEME COMPLETED.—It is reported in *Electric Light and Power* that during the past year the $100,000,000 scheme of electrifying the entire passenger and freight track of the Pennsylvania Railway between New York, Philadelphia, Baltimore and Washington has been completed. It is stated to be the largest single project of its kind ever undertaken.

Communications

Germany.—TELEVISION.—An *Exchange* message from Berlin states that a combined telephone and television service between Berlin and Leipzig was opened last Sunday. The charge is 5s. for three minutes.

Kirkwall (Orkney).—DIRECTION FINDING FOR AIRCRAFT.—Radio direction-finding apparatus is to be installed at Kirkwall for the guidance of aircraft. The Air Ministry is meeting £1,200 a year of the cost and Orkney County Council £100 a year.

Norway.—TELEVISION EXPERIMENTS.—An Oslo radio firm is stated to have obtained a special concession to commence private television experiments. Work has already been started on the erection of an ultra short-wave transmitter for the purpose, and it is said that the first transmissions will take place in the spring. The firm intends to market a television receiver at about 1,000 kroner (£50).

Sweden.—TELEPHONES.—Figures at present available regarding the number of telephone subscribers in Sweden show that during the year just ended there were 103 telephones per 1,000 inhabitants. The aggregate increase was roughly 28,000 telephones, which compares with an increase of 27,142 in 1930, the previous record year. At present the first seven countries in order of telephone density are U.S.A., Canada, Denmark, New Zealand, Sweden, Switzerland, and Norway.

Electrifying the S.R. Portsmouth Line

RAPID progress is being made with the electrification of the Southern Railway's main line to Portsmouth Harbour, *via* Woking and Guildford, and with the subsidiary extensions from Woking to Alton and from Staines to Weybridge. The whole scheme is estimated to cost nearly £3,000,000, and is being carried out under the Railways Agreement Act, 1935. It involves nearly 95 route miles, corresponding to 242 single-track miles, and it is hoped that the line will be ready for electrical operation by July, 1937. The through run from London to Portsmouth will cover 74 route miles and will be one of the longest stretches of electrified track in the country.

Control rooms are being provided at Woking and Havant, while there will be twenty-six sub-stations and eighteen track-paralleling huts. The buildings for six of the sub-stations are now practically finished, and the electrical equipment for three of them has been delivered and is in process of erection. Electrical energy for operating the new services outside the Western Section Suburban Area will be obtained from the C.E.B. sub-stations at Woking and Portsmouth (Wymering), and the railway company's own power house at Durnsford Road, Wimbledon, is being extended to supply the additional energy required to operate the new electric services in the Western Suburban Area. At present over 20 miles of h.v. cable, 33 miles of pilot cable, and 71¼ miles (5,700 tons) of conductor rail, 52 miles of which is bonded, have been laid.

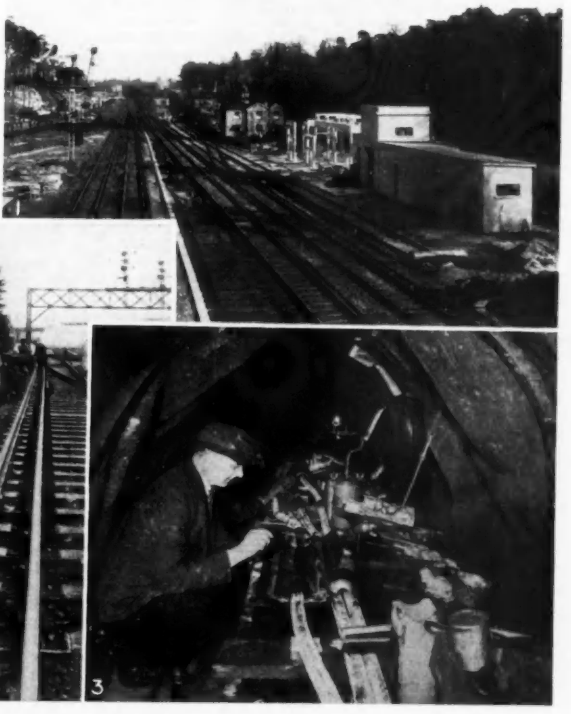
Forty-eight four-coach motor units, nineteen of which will be provided with kitchen cars, are being constructed to operate the new services. The stopping services will be operated by specially constructed new stock, which will consist of thirty-eight two-coach units, eight two-coach motor units, six three-coach motor units, and five two-coach trailer units. The aggregate horse-power of the traction motors being manufactured to propel this stock is over 75,000. The rolling stock is being constructed at the company's Eastleigh works, and deliveries of the first train equipments will shortly be made.

The satisfactory financial results of the latest Southern Railway electrification schemes were referred to by Mr. R. Holland-Martin, chairman of the company, at the annual meeting held last week. He showed that, whereas in 1932 it was estimated that an increase of 27.1 per cent. on the then revenue of the area would be sufficient to pay for the increased cost of working due to electrifying the line to Sevenoaks, including the interest on the amount charged to capital, actually, in the first year operated under electric traction, the revenue had increased by 41 per cent. over the 1932 figures, and the passengers carried by 55 per cent. In the case of the Eastbourne and Hastings section it was estimated that a revenue increase of 1.25 per cent. would have met the cost of electrification, but in the first six months of electric working (July to December last) receipts were up by 16 per cent. and the number of passengers carried by 22 per cent.

Capital expenditure on electrification works carried out during last year amounted to £622,000, and under the Government guaranteed loan scheme the company was to apply approximately £6,000,000 to works, mostly of this nature, during the next five years (see ELECTRICAL REVIEW, November 8th, page 654).

Referring to breakdowns on the electrified system, the chairman said that they were going into the matter carefully, and hoped to find some means to prevent at any rate such an effective "black-out" as occurred recently. He pointed out that there had been only two really bad occurrences of this kind.

The chairman of the Littlehampton Urban District Council recently informed the Finance Committee that he had been authorised to state that the town would be linked up with London by an electric service through West Worthing in time for the summer traffic of 1938.



(1) Tracks fitted with conductor rails at Weybridge Junction, and sub-station buildings ready for the installation of electrical equipment. (2) Drilling the holes for the conductor rail bonds. (3) Jointing an e.h.v. cable

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberystwyth.—March 13th. Electricity Department. One 520-kW Diesel d.c. generating set and d.c. switchboard and cable connections. (February 21st.)

Australia.—HOBART.—April 20th. Municipal Tramways. One 11,000-V, three-phase, 750-kW, a.c. to d.c. rotary convertor or rectifier. (T.Y. 10412.)*

Barnoldswick.—March 16th. Electricity Department. Cables for one year. (See this issue.)

Bath.—March 11th. Corporation. Electrical materials for one year. (February 28th.)

Bootle.—March 17th. Health Committee. Electrical work at proposed public convenience and shelter, Regent Road. Borough engineer and surveyor, Town Hall.

Bridport.—March 23rd. Electricity Department. Overhead lines and air-break switchgear. (February 28th.)

Brighton.—March 9th. Electricity Department. Cables for one year. (February 28th.)

Bristol.—March 18th. Electricity Department. Fifteen e.h.p. transformer pillars. (See this issue.)

Bromley (KENT).—March 12th. Electricity Department. Transformers. (February 28th.)

Bury.—March 12th. Electricity Department. Cables for one year. (February 28th.)

Cheadle and Gatley.—March 13th. Electricity Department. Extension to existing 6.6-kV switchgear. (February 28th.)

Cleethorpes.—March 9th. U.D.C. Transformer, cable, switchgear and main stores. (February 28th.)

Clitheroe.—March 14th. Electricity Department. Cables and meters for one year. (February 28th.)
March 16th. H.d. copper conductor. (See this issue.)
March 23rd. Wood poles. (See this issue.)

Derby.—March 9th. County Council. Electrical accessories for one year. G. H. Widdows, County architect, Derbyshire County Council Offices (deposit £2 2s.).

Dumfries.—March 23rd. County Council. Electrical wiring, &c., at Academy. J. Robson, county clerk, County Buildings (deposit £1 1s.).
March 20th. Town Council. Electricity lighting at 110 houses on the Nithside estate. R. S. Osborne, borough surveyor.
March 17th. Dumfries and Galloway Joint Sanatorium Board. Electrical and heating works at extensions of the Lochmaben Sanatorium. J. Robson, clerk to the Board, County Buildings.

Dundee.—March 19th. Harbour Trustees. Two 3-ton (alternatively one 3-ton and one 5-ton) electric travelling portal type jib cranes. General manager and engineer, Harbour Chambers.

Ealing.—March 13th. Electricity Department. Electric delivery van. (See this issue.)

East Grinstead.—March 18th. U.D.C. Meters for one year. (See this issue.)

Edinburgh.—March 12th. Electricity Department. Materials for one year. (February 21st.)

Farnworth.—March 9th. Electricity Department. Electrical supplies for one year. (February 28th.)

Great Western Railway.—March 20th. Stores for one year. (See this issue.)

Great Yarmouth.—March 26th. Electricity Supply Department. Materials for one year. (See this issue.)

Horsham.—March 11th. Electricity Department. Two steel kiosk sub-stations and two 300-kVA transformers. (February 28th.)

Houghton-le-Spring.—U.D.C. Electrical installations in ninety-five houses on the Chilton Moor estate. V. J. Hunter, surveyor, Newbottle Street.

Hull.—Telephone Committee. Telephone cables. (See this issue.)
Automatic table telephones. (See this issue.)

India.—March 10th. Bengal and North Western Railway Co., Ltd. Tungsten filament lamps. (February 28th.)
SIMLA.—April 21st. Stores Department. Wall plugs, ceiling roses, &c., required during the period from July 1st, 1936, to June 30th, 1937. (T.Y. 10402.)*

Keighley.—March 12th. Electricity Committee. One year's supply of 6,600-V and 660-V p.i. l.c. underground cables and v.i.r. and metal-sheathed cables. H. Webber, borough electrical engineer and general manager, Electricity Offices and Works, Coney Lane.

Keith.—March 16th. Town Council. Converting the street lighting system to electricity, including supply of fittings and service cables. G. S. Stewart, borough surveyor.

Lancaster.—Electricity Department. Cables. (See this issue.)

Leeds.—March 18th. Housing Commmittee. Electrical work at estate including 1,763 dwellings in York and Selby Road, 664 at Crossgates, 140 at Halton, and 310 at Ivy House and East End Park. R. A. H. Livett, housing director, 26, Great George Street (deposit £2 2s.).
March 17th. Education Committee. Various works, including electrical, in various buildings during twelve months ending March 31st, 1937. G. Guest, director of education, Education Offices.

Leyton.—March 9th. Electricity Department. Cables for one year. (February 21st.)

London.—HACKNEY.—March 16th. Borough Council. Electrical installation for a block of flats. (February 28th.)
POPLAR.—March 18th. Borough Council. Switchgear, transformers and cables for one year. (See this issue.)

Manchester.—March 10th. Electricity Committee. (A) 33-kV three-phase a.c. switchgear for the Stuart Street (Bradford) and Ellen Street (Droylsden) sub-stations. (B) Supervisory control gear for the Failsworth and Sale sub-stations. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall (deposit £1 1s. each).
March 25th. Service cut-outs and cables for one year. (See this issue.)
March 23rd. Oil-immersed reactors, transformers, switchboard and fire-extinguishing equipment. (See this issue.)
March 14th. Central Purchasing Committee. Electric lamps for twelve months ending June 30th, 1937. H. C. Lamb.

Neath.—March 12th. Electrical Engineer's Department. Electrical overhead line, service material and electric lamps for the year ending March 31st, 1937. G. H. Thomson, electrical engineer, Council Offices, Orchard Street.

Newark-on-Trent.—March 31st. Electricity Department. Transformers, kiosk and switchboards. (February 28th.)

Northern Ireland.—BELFAST.—March 13th. Electricity Department. Ventilating and air filtering plant for the head office. (February 28th.)
April 3rd. Steam boiler plant and auxiliaries. (February 28th.)

Portland.—March 9th. Electricity Department. Cables, meters, cookers, kettles, &c., for one year. (February 21st.)

Portsmouth.—March 30th. Electricity Department. Substation e.h.p. and l.p. switchgear and steel kiosks with switchgear for one year. (See this issue.)

Reigate.—March 14th. Electricity Department. Electrical materials for one year. (February 28th.)

Rhondda.—March 28th. Electricity Department. Meters and copper wire and house service material for one year. (February 21st.)

Rochdale.—March 16th. Electricity Department. 33-kV substation equipments and 33-kV switchgear extension at Dane Street power station. (February 21st.)

Salford.—March 12th. Corporation. One 12,500-kVA transformer. (February 28th.)

Sheffield.—March 9th. Electricity Department. Transformers. (February 21st.)
March 12th. Transformers. (February 28th.)

South Africa.—CAPE TOWN.—March 25th. Electricity Department. Ironclad service cut-outs. (T.Y. 10393.)*
PRETORIA.—March 27th. Union Tender and Supplies Board. Switchboard cords. (T.Y. 10392.)*
BLOEMFONTEIN.—April 6th. City Council. Turbo-alternator condenser unit with coupling transformers, switchgear, cables, &c. (T.Y. 10401.)*
JOHANNESBURG.—April 18th. City Council. Electric lamps during the year commencing August 1st, 1936. (T.Y. 10422.)*

Stoke-on-Trent.—March 11th. Electrical Engineer's Department. Motors, meters and overhead lines for one year. (February 28th.)

Stratford-on-Avon.—March 18th. Deep-borehole, electrically-driven multi-stage pumping plant with accessories at the Warwick Road pumping station. F. W. Jones, borough surveyor, Municipal Offices (deposit £2 2s.).

Swinton & Pendlebury.—March 16th. Electricity Department. Materials for one year. (See this issue.)

Wallasey.—March 23rd. Electricity Department. Switchgear, transformers and cables. (February 21st.)

Warrington.—March 9th. Water Department. Various works and plant, including electrically driven, low-lift, centrifugal pumps (180,000 gal. per hr. each) and filtration equipment. J. Gray, water engineer, Town Hall (deposit £2 2s.).

Weymouth and Melcombe Regis.—March 16th. Electricity Department. 11,000-V cable and transformer kiosk with e.h.p. and l.p. switchgear. (February 28th.)

Workington.—March 16th. Electricity Department. Electrical materials for one year. (February 28th.)

Worthing.—March 19th. Electricity Department. Cables for one year and a transformer kiosk sub-station. (See this issue.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 36, Old Queen Street, London, S.W.1.

Contracts Closed

Australia.—COMMONWEALTH.—P.M.G.'s Department. Accepted. Transmitters and parts (£2,920).—Siemens (Aust.) Pty., Ltd. Secrecy equipment, short wave telephone services (£544).—Standard Telephones & Cables (A'sia). Motor generators and rectifiers (£879).—British General Electric Co., Ltd.
NEW SOUTH WALES.—Public Works Department. Accepted. X-ray apparatus (£1,009).—Philips Lamps (A'sia), Ltd.—*Tenders.*

Bexhill.—Electricity Committee. Recommended. Conversion of wireless apparatus, &c. (£1,010).—Radio-Menders, Ltd.

Birkenhead.—Electricity Committee. Accepted. Wiring eighty-eight houses under the assisted scheme (£359).—Park Electrical Co. Two 500-kVA transformers (£385).—Electric Construction Co., Ltd. Switchgear (£1,255).—General Electric Co., Ltd. Two switch units (£1,498).—Metropolitan-Vickers Electrical Co., Ltd.

Eastbourne.—Electricity Committee. Annual tenders recommended:—Cable ducts, Albion Clay Co., Ltd.; cast-iron and steel poles and lanterns, Revo Electric Co., Ltd.; brackets and reflectors, Electric Street Lighting Apparatus Co., Ltd.; h.d. copper, Rowland & Co., Ltd.; cadmium copper, p.b.j. and l.c. cambric and v.i.r. cable, Enfield Cable Works, Ltd.; cable, Craigpark Electric Cable Co., Macintosh Cable Co., Ltd.,

Standard Telephones & Cables, Ltd., Mersey Cable Works, Ltd.; switchgear, Ferguson, Pailin, Ltd.; transformers, British Electric Transformer Co., Ltd.; cooker control units, M.K. Electric, Ltd.; cookers, Jackson Electric Stove Co., General Electric Co., Ltd.; electric kettles, J. Godden (London), Ltd.; overground disconnecting boxes, W. Lucy & Co., Ltd.

London.—L.C.C. Education Committee. Accepted. Electrical installation at central and elementary schools, Myrdle Street (£1,179).—G.E.T. Installation Co.

Manchester.—Housing Committee. Accepted. Electrical installations in 236 flats at Collyhurst and 128 at West Gorton.—E. M. Evans & Co., Ltd.; and in 122 houses at Newton Heath.—R. H. Clampett & Co., Ltd.

Electricity Committee. Accepted. 33,000-V switchgear, reactors, &c., for Barton power station extensions.—British Thomson-Houston Co., Ltd. Arc-controlling devices and 33,000-V switchgear at the Dickinson Street, Denton (West) and Droylsden (East) sub-stations.—Ferguson, Pailin, Ltd.

Education Committee. Accepted. Alterations to electrical installations in Seymour Road municipal school.—W. Hassel & Co., Ltd.

Salford.—Electricity Committee. Recommended. 12,500-kVA transformer (£3,650).—Yorkshire Electric Transformer Co., Ltd.

Health Committee. Recommended. Electric lifts at two blocks at Hope Hospital (£668).—Etchells, Congdon & Muir, Ltd.

Sheffield.—Electricity Committee. Accepted. 33-kV switchgear for the Blackburn Meadows power station (£86,090).—A. Reyrolle & Co., Ltd. Turbo-alternator and condensing plant at the Neepsend power station (£105,064).—British Thomson-Houston Co., Ltd.

Transport Committee. Accepted. Twenty-five tramcar trucks (without wheels and axles) (£157 each).—E.M.B. Co., Ltd. Twenty-five traction resistances (£13 each).—Metropolitan-Vickers Electrical Co., Ltd. Twenty-five car sets of control and braking systems (£190 per set) and of platform brake gear (£23 per set), and twelve car sets of control and braking system for conversion purposes (£178 per set).—Maley & Taunton, Ltd. Ten tramcar controllers (£45 each).—British Thomson-Houston Co., Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted. Substation switchgear and static transformers.—Metropolitan-Vickers Electrical Co., Ltd. Mains and cables.—Callender's Cable & Construction Co., Ltd.

Wimbledon.—Electricity Committee. Accepted. Replacement of switchgear for 2,000-V high rupturing capacity equipments (£1,398) and 2,000-V switchgear extensions in sub-stations (£1,160).—English Electric Co., Ltd. Replacing 11,000-V high rupturing capacity switchgear (£1,227) and 11,000-V switchgear extensions in sub-stations (£2,650).—A. Reyrolle & Co., Ltd.

Forthcoming Events

Institution of Electrical Engineers.—Monday, March 9th. Institution, London. 7 p.m. Discussion on "Electric Furnaces." To be opened by Mr. W. S. Gifford.

Meter and Instrument Section.—Friday, March 6th. Institution, London. 7 p.m. "The Selenium Iron Photo-Rectifier-Cell." Prof. J. T. McGregor-Morris and Mr. R. M. Billington. "The Selenium Rectifier Photo-Cell." Mr. J. S. Preston.

North Midland Centre.—Friday, March 6th. Hotel Metropole, Leeds. 7 for 7.30 p.m. Annual dinner.

Mersey and North Wales (Liverpool) Centre.—Monday, March 9th. The University, Liverpool. 7 p.m. Joint meeting with the Liverpool Engineering Society. "Modern Electrical Illuminating Devices." Mr. J. W. Ryde.

North-Eastern Centre.—Monday, March 9th. Armstrong College, Newcastle-upon-Tyne. 6.15 p.m. "The High-Pressure Mercury-Vapour Lamp in Public Lighting." Messrs. G. H. Wilson, J. M. Waldram and Lt.-Cmmdr. E. L. Damant.

South Midland Centre.—Monday, March 9th. James Watt Memorial Institute, Birmingham. 7 p.m. "The Development of the Single Break Oil Circuit-breaker for Metal-clad Switchgear." Messrs. D. R. Davies and C. H. Flurscheim.

Western Centre.—Monday, March 9th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Applications of the Hot-Cathode Grid-controlled Rectifier, or Thyratron." Mr. A. L. Whiteley.

North-Western Centre.—Tuesday, March 10th. College of Technology, Manchester. 7.30 p.m. Faraday Lecture. "Television—An Outline." Dr. E. Mallett.

Scottish Centre.—Tuesday, March 10th. 39, Elmbank Crescent, Glasgow. 7.30 p.m. "Patents for Inventions." Mr. H. J. Fitzpatrick.

Hampshire Sub-Centre.—Wednesday, March 11th. University College, Southampton. 7.30 p.m. "Electric Arc Welding Equipments with Special Reference to A.C. Welding." Mr. T. A. Long.

Dundee Sub-Centre.—Thursday, March 12th. University College, Dundee. 7.30 p.m. "Remote Automatic Control." Mr. A. F. Stevenson.

Association of Mining Electrical Engineers (*South Wales Branch*).—Saturday, March 7th. Park Hotel, Cardiff. 7 p.m. Annual dinner.

Electrical Power Engineers' Association (*Kent Section*).—Saturday, March 7th. Royal Star Hotel, Maidstone. Annual dinner and dance.

Institution of Engineers-in-Charge.—Wednesday, March 11th. St. Bride Institute, London, E.C.4. 7.30 p.m. "Modern Developments in Welding." Mr. C. G. Bainbridge.

Institution of Post Office Electrical Engineers (*South-Western Centre*).—Wednesday, March 11th. Royal Empire Society Rooms, Bristol. Joint meeting with the Western Centre of the Institution of Electrical Engineers. "Recent Developments in Unit Automatic Exchanges." Messrs. C. G. Grant and B. Winch.

Junior Institution of Engineers.—Friday, March 13th. Hotel Metropole, London, W.C.2. Annual dinner.

Notes

South-East England Scheme Amended

On Monday the Central Electricity Board published the South-East England (Alteration and Extension) Scheme, 1936, with an explanatory memorandum prepared by the Electricity Commissioners. The new scheme amends the original scheme adopted by the Board in February, 1928, by "selecting" the generating station of Watford Corporation (formerly scheduled for working under temporary arrangements) on the ground that the improvement in economy of operation of the station during recent years has warranted selection and extension for dealing with the increasing loads at Watford and in the northern part of the area. The new scheme also alters the routes of certain main transmission lines and the situation of certain sub-stations as a result of the systems of authorised undertakers, more particularly in East Sussex near the borders of Surrey and Hampshire, having developed on lines different from those originally contemplated and also as a result of the railway electrification developments in the area.

Railway Electrification in the Midlands

Referring to suggestions made by speakers at the B.I.F. at Birmingham, regarding the electrification of the railways in Birmingham and the Midlands, Mr. H. J. Manzoni (city surveyor, Birmingham) stated last week that he was emphatically in favour of electrification. There were engineering difficulties but they could be overcome; and incidentally, a system of railway electrification would be an immense help in dealing with the old problem of New Street railway station.

The Electrical Association for Women

At a meeting recently held in Barnes, presided over by Mr. C. S. Davidson, the borough electrical engineer, it was decided to form a local branch of the E.A.W. and an inaugural meeting will be held on March 31st. The Mayoress (Mrs. Austin) has consented to act as president, and other officers include Mrs. Chris. Wilson (chairman), Mrs. Murphy (hon. treasurer) and Mrs. Sexton (hon. secretary).

Speaking at the annual luncheon of the Halifax and District Branch of the Association on February 25th, Lady Fisher-Smith, president, suggested that arrangements should be made in the next garden village for communal laundries where women could do their washing electrically. Sir John Brooke, vice-chairman of the Electricity Commissioners, considered that in the future houses which did not possess full electrical service would be considered completely out of date.

The Ampère Centenary Meeting at Lyons

The centenary of the death of André-Marie Ampère is being celebrated in Lyons: the proceedings opened yesterday (Thursday), and they continue until March 8th. The inaugural meeting was to take place at the Palais de la Foire Internationale, where an electrical exhibition has been arranged. Conferences are also being held, at which a discourse is to be given by M. Dutacq descriptive of the life of Ampère. One of the most attractive items in the full and varied programme which the Comité d'Organisation, under the presidency of M. Piaton, has prepared, is a visit to-day (Friday) to the village of Poleymieux, the home of the Ampère family during the life of the great physicist. The progress of electrical industry and natural science will be illustrated by demonstrations, exhibits, and accounts of modern researches, by leading French engineers and scientific investigators.

Refractory Materials Research

With the support of the Department of Scientific and Industrial Research a conference was held in London on February 26th, the aim being to extend the activities of the British Refractories Research Association. This Association deals with fire-resisting materials, such as are used for lining furnaces (including electrical) and it is anxious to include in its membership other allied industries, such as pottery and porcelain. The Association was formed in 1920. Its income from trade sources is under £5,000 a year and from all sources only just over £8,000, which it is desired to increase to £20,000.

Appointments Vacant

Consumers' engineer, chief clerk, storekeeper and male shorthand typist for Bethnal Green Electricity Department.

Junior assistant for Eastbourne Electricity Department.

Resident engineer for South-East Essex Technical College, Dagenham.

Electrical engineer for the Palestine Public Works Department.

(See our advertisement pages to-day.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

Stella fire.

Micamab varnish.

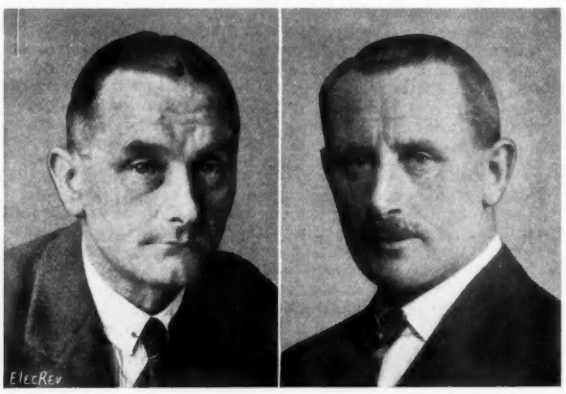
Neata 5-A fuse bridges.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

With a view to securing a greater measure of co-operation between the various road services provided by the London Passenger Transport Board, the organisation has been revised. **Mr. A. C. Richardson** becomes Chief Inspecting Officer and will take up special duties in the vice-chairman's office, while, as reported in the ELECTRICAL REVIEW last week, **Mr. T. E. Thomas** will be responsible for the operation of all the Board's road services, with the title of General Manager, Road Transport. Subject to this, it is intended to retain the separate organisations for the staff and operation of the various forms of road transport. Mr. Thomas has had wide experience in the operation of all forms of surface transport. He entered the drawing office of the London United Tramways Co. in 1899. Two years later he was engaged in electrification work under the late Sir Clifton Robinson, the managing director. Later he was appointed resident district engineer. When the London United Tramways Co. was absorbed by the Underground Group in 1910, Mr. Thomas was transferred to publicity and traffic work for the Group. In 1913 he became commercial assistant dealing with fares, routes, &c., consequent upon the Group having acquired the London General Omnibus Co. He became development superintendent of the London County Council Tramways in 1917, and in 1925 he was appointed traffic manager, succeeding Mr. Bruce as general manager in 1930. Mr. Thomas was appointed general manager of the Transport Board's tramways in October, 1933. He is a foundation member and gold medallist of the Institute of Transport, and is chairman of the Tramways, Light Railways and Transport Association.



[*Vandyk*

Mr. T. E. Thomas **Mr. A. C. Richardson**

Mr. S. G. Pike has been elected chairman of the British Electrical Development Association (Northern Counties Area), and **Mr. S. Tillotson** (West Hartlepool) has been elected vice-chairman.

Mr. S. Mavor, of Messrs. Mavor & Coulson, Ltd., has been nominated for the presidency of the Mining Institute of Scotland.

Dr. R. G. Hutchison has been appointed whole-time radiologist to the Royal Alexandra Infirmary, Paisley. He was previously assistant director at the Holt Radium Institute, Manchester, and is at present assistant radiologist to the Western Infirmary, Glasgow, and assistant in radiology at the University of Glasgow.

Mr. G. W. Maxfield

Mr. G. W. Maxfield, A.M.I.E.E., author of the article on "Turbine Back Pressure" (page 345), was trained under the borough electrical engineer of Burnley. After two years in H.M. Destroyer Service during the war he held junior positions at Dundee and Blackburn, and between 1926 and 1933 he was charge engineer at Swindon, Carlisle and Bradford. In 1933 he was appointed C.E.B. control engineer in South-West England and South Wales, being promoted to day control engineer in 1934.

Mr. E. E. Bassett has resigned his position as general manager of Lustray Products, and has joined Messrs. C. M. Churchouse, electrical fittings manufacturers, of Clarendon Place, W.11.

Mr. A. G. Salter, A.I.E.E., has been appointed meter superintendent with the Central Sussex Electricity, Ltd., and its associated companies. He is at present meter superintendent with the Sevenoaks and District and Horley and District Electricity Supply Companies, and has previously held appointments with the Hammersmith, Aberdare and Blackpool electricity undertakings.

Mr. R. Cochrane, for the past seven years engineer-designer of industrial cooking and heating apparatus with the Automatic Electric Co., Ltd., Liverpool, informs us that he has commenced duties as chief draughtsman-designer with Messrs. Henry Wilson & Co., Liverpool.

Mr. A. S. Hampton, divisional signal and electrical engineer for Scotland for the London, Midland & Scottish Railway Co., who has retired after forty-three years' service was, on February 28th, presented with a silver salver by his fellow officials. Mrs. Hampton received a diamond platinum ring. Since 1923 he has been responsible for all the L.M.S. electrical work in Scotland, his principal works including installations of coal conveyors and other electrical plant at Ayr and Grangemouth docks, and the introduction of the new signalling system at St. Enoch Station, Glasgow. Mr. Hampton is a member of the Institution of Electrical Engineers, the Institute of Transport, and the Institute of Railway Signalling Engineers.

A presentation of an oak chiming clock and silver cigarette case was made to **Mr. F. C. Brittain,** who recently retired from the position of works manager to the Westinghouse Brake & Signal Co., Ltd. The presentation was made by Mr. H. A. Creese, the present works manager, and a further presentation of a gold wristlet watch and wallet of notes was made, this being subscribed to by 1,530 employés. Mr. Brittain was connected with the company for thirty-eight years.

Mr. R. Illingworth, whose successful four-day development effort is mentioned in a "leaderette," has been borough electrical engineer and manager at Poplar for about three years, having previously been deputy there for twelve months. Before going to Poplar he was deputy electrical engineer at Portsmouth, having taken up that position in 1929 after being chief electrical engineer to Messrs. Cory Bros. & Co., Ltd., for about nine years. While he has been at Poplar he has given special attention to the development of the domestic load and the results have been very gratifying: at the end of last year there were connected to the mains about 3,000 cookers and 750 wash-boilers, and the rate of progress is being well sustained.

[*Jerome, Ltd.*

Mr. R. Illingworth

Col. R. E. B. Crompton was in reminiscent mood when presiding at the annual meeting of the Kensington & Knightsbridge Electric Lighting Co. on February 26th. He reminded the shareholders that this year marked the company's golden jubilee. It was fifty years ago (July, 1886) that he and certain of his friends formed the Kensington Court Electric Lighting Co., the company's name being subsequently changed when it widened its area.

Mr. W. H. Lawes, B.Sc., A.M.I.E.E., late instrument designs engineer with the Metropolitan-Vickers Electrical Co., Ltd., has joined the staff of Salford Electrical Instruments, Ltd.

The *Electrical World* reports that the official nominee for the presidency of the American Institute of Electrical Engineers for the 1936-37 session is **Mr. A. M. MacCutcheon,** engineering vice-president of Reliance Electric, Cleveland.

Councillor F. Dale was appointed chairman of the Electricity Committee at a recent meeting of the Congleton Town Council. He was also appointed representative on the North-West Midlands Joint Electricity Authority. In these positions he succeeds Mr. F. C. Pass.

Mr. R. W. J. Bennion, installation engineer with the Colwyn Bay Corporation Electricity Department, has been appointed consumers' engineer at the Basingstoke electricity works.

Mr. D. S. Panisset, showroom assistant with the Eastbourne Corporation Electricity Department, has secured an appointment in the Research Department of Messrs. Belling & Co., Ltd.

Mr. H. C. Babb, resident engineer and manager of the Musselburgh Electric Light & Traction Co., Ltd., has been nominated for the chairmanship of the Scottish Centre of the Institution of Electrical Engineers.

Mr. E. Calvert, who will be retiring on March 31st after thirty-four years' service as chief electrical engineer and manager to the Finchley Corporation and its predecessor, the Finchley Urban District Council, was the guest of the members of his department at a dinner and concert on February 29th at "Arcadia," Finchley. Mr. Calvert was accompanied by Mrs. Calvert and his daughter and son. The occasion was made the opportunity of presenting Mr. Calvert with an illuminated and autographed plaque. The presentation was made by Mr. B. Lewis, the oldest member of Mr. Calvert's staff. Mr. A. Cumber (commercial assistant), paid a tribute to Mr. Calvert, and referred to the excellent work accomplished by him since he was appointed to start the undertaking in 1901. Mr. H. W. May (station superintendent) welcomed the ladies present, and Mrs. Calvert responded.

Viscount Falmouth, Companion I.E.E., President of E.D.A., has accepted the invitation of the Executive Committee to be President of the Electrical Industries Benevolent Association for the ensuing year in succession to Sir Felix J. C. Pole. The formal election will take place at the annual general meeting on April 3rd, at the Savoy Hotel. This meeting will be followed by a luncheon at 1 o'clock at which Viscount Falmouth will preside, when the toast of the E.I.B.A. will be proposed by Mr. J. M. Kennedy, Pres. I.E.E. While the annual general meeting is for members of E.I.B.A. only, the luncheon is open to all. Tickets (10s.) may be obtained from the Executive Officer, Mr. A. Hugh Seabrook.

Mr. H. M. Cotterill, late of the Major Equipment Co., Ltd., has joined the board of the Strand Electric & Engineering Co., Ltd. Since taking his degree in engineering at Cambridge, Mr. Cotterill has obtained experience at the G.E.C. Research Laboratories at Wembley, afterwards joining in the formation of the Major Equipment Co., Ltd. He is a member of the Illuminating Engineering Society.

Mr. C. Creasey, senior assistant chemist at the Barton power station, Manchester, has been appointed works chemist at the Halifax Corporation power station.

Obituary

Mr. C. D. Burnet.—The death occurred on February 29th of Mr. Charles Douglas Burnet, M.I.E.E., M.I.Mech.E., of Seton, Twickenham. Mr. Burnet, who was in his sixty-third year, was a London University College man. In the earlier years of his career he was assistant engineer on the Oxford electricity supply system, and city electrical engineer at Carlisle. He was also on the staff of Messrs. Kennedy & Jenkin, and later (in 1908) engineer and manager of the Rail Welding Department of the Tudor Accumulator Co., Ltd. For some years past he has been interested in electric welding work and has acted in an advisory capacity.

Mr. George Verity.—The death of Mr. George Herbert Verity, M.I.E.E., removes from amongst us one who held a name always very familiar to the electrical world. He was the son of John Verity, of Yorkshire, and was born sixty-nine years ago, and had several brothers, one of whom was identified with the electrical industry many years ago. The house of Verity in the neighbourhood of Covent Garden was one of the earliest electrical companies in London, and after his education and electrical training at Dresden, Berlin, and elsewhere, George took a leading part in that business. He became chairman of Veritys, Ltd., in 1906, and continued to be associated with the company until 1933, when he resigned to devote more time to his other interests.

Nearly thirty years ago Mr. Verity began his connection with the Charing Cross Hospital, as chairman, and the enthusiasm and energy which he devoted to the affairs of that institution have made it a lasting monument to his memory. During the greater part of the same period his electrical interest took him more directly into electricity supply enterprises than in his early "Veritys" days. For some years he had been, and was at the time of his death, a director of the Metropolitan Electric Supply Co., Ltd. He was also a director of the Midland Counties Electric Supply Co., Ltd., and chairman of directors of the Derbyshire and Nottinghamshire, and the Leicestershire and Warwickshire Electric Power Companies. In all matters appertaining to the operation of these companies he was keenly interested. He had been a High Sheriff for the County of London and was a Justice of the Peace. He married in 1916 the widow of Mr. C. Hamilton Walker. Mr. Verity died at his home, The Croft, Chesham Bois, Bucks, on Friday last. The funeral ceremony was private but a memorial service was held at St. Martin-in-the-Fields on Monday, the following being among those present:—Mr. Hugh Balfour (representing Mr. George Balfour, M.P.), Mr. H. S. Beatty (Midland Counties E.S. Co.), Mr. G. Dudley Prince (Balfour, Beatty & Co.), Mr. E. A. Hounsell (Brush Electrical Engineering Co., Ltd.), and Mr. B. C. Evans (Veritys, Ltd.).

Mr. Albion Snell.—We have to record the death of Mr. Albion Thomas Snell, M.Inst.C.E., M.I.E.E., of Albion T. Snell & Partners, consulting electrical engineers, London. Mr. Snell was a Devonshire man, but was educated at King's College and at the City and Guilds Technical College under Ayrton and Perry. In 1885 he joined Immisch's, and while there took up the question of electrical power transmission, designing and installing the Immisch motor. He then turned his attention to colliery electrification, and later to electric tramway work, including design work for battery tramcars in London. In the early 'nineties of last century he was interested in alternating currents and read papers before the Institution and at British Association meetings. He was one of the few remaining members of the jury of the Crystal Palace Electrical Exhibition held in 1892. He was also the author of technical books and articles in the technical Press. During his forty years' practice as a consulting engineer he came into close touch with prominent men in electrical and industrial undertakings, and had been identified with the control of electrical installation work at some of our great exhibitions. He was responsible also for a great deal of work connected with electrical mining installations. As a Common Councillor he represented the City of London on the London and Home Counties Joint Electricity Authority. Mr. Snell died very suddenly from pneumonia on Sunday last, in his seventy-eighth year. A service was held at the Golders Green Crematorium on Tuesday morning.

The late Mr. Albion T. Snell

Mr. J. Burbridge, formerly chief electrical engineer to the Leeds City Tramways Department, died on February 29th at the age of seventy-five at his home in Leeds. When a young man Mr. Burbridge went to Victoria, B.C., where he carried out his first work in connection with overhead trolley systems. He returned to England in 1891 and joined the Thomson-Houston International Electrical Co., at Leeds, supervising the first overhead electric trolley system to be started in this country, a line being opened between Sheepcar and Oakwood in that year. When the Corporation took over the system in 1896, he was appointed clerk of works, and became chief electrical engineer of the Transport Department in 1897, a position which he held until his retirement in 1926.

Mr. A. M. Ritchie, a telephone pioneer in America, died recently at Miami, Florida, in his seventy-seventh year. He entered the telephone industry in 1878, and in 1884 was transferred to the mechanical department of the Bell Telephone Co. of Canada in Montreal, now the Northern Electric Co., Ltd., of which he eventually became assistant general superintendent. He retired from active service in 1931.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Production Indicators, Ltd.—Private company. Registered February 22nd. Capital, £1,000. Objects: To carry on the business of electricians, engineers, machinists, carpenters, manufacturers of radio, television, electrical, optical and other apparatus, &c. The subscribers are: F. A. Howick, 91, Carlton Road, Gidea Park, Essex, and D. G. Crittenden, 1, Morland Road, Ilford. Solicitors: J. H. John & Co., 40, Russell Square, W.C.1.

Frank Sword, Ltd.—Private company. Registered February 27th. Capital, £1,000. Objects: To acquire the business of an electrical engineer and contractor carried on by F. Sword at 19, Withington Road, Whalley Range, Manchester. The directors are: F. Sword, 19, Withington Road, Whalley Range, and H. B. Price, 21, Withington Road, Whalley Range.

Batteries & Motor Improvements, Ltd.—Private company. Registered February 24th. Capital, £7,000. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in electrical accumulators and all other accessories related to the motor, aviation and electrical industries, &c. The directors are: B. O. S. Savage, 3, Holly Mount, Hampstead, N.W.3, and Susanne Boucherat, 42, Roe Green, N.W.9. Secretary: B. O. S. Savage. Registered office: Astor House, 95, Aldwych, W.C.2.

W. L. R. Howes, Ltd.—Private company. Registered February 26th. Capital, £100. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in all kinds of electrical fittings and apparatus, &c. The subscribers are: A. Just, 104, Coolgardie Avenue, Highams Park, E.4, and Rose Freeman, 96, Cleveland Gardens, Hendon Way, N.W.2.

Electric Vans, Ltd.—Private company. Registered February 29th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in electric and motor vans, wagons, lorries, cars, &c. The directors are: A. S. Skipp, Lawn House, Bengeo, Hertford, and H. W. Tomlinson, 34, Bernard Street, W.C.2. Solicitor: J. F. W. Harrison, 98/100, Fore Street, Hertford.

Lesta, Ltd.—Private company. Registered February 24th. Capital, £100. Objects: To carry on the business of electrical engineers, electrical wiring contractors, radio and mechanical engineers, &c. The directors are: A. E. Gale, "Highfield," Spareleaze Hill, Loughton, Essex, and four others. Registered office: 106, Church Hill, Loughton, Essex.

Real Radio, Ltd.—Private company. Registered February 24th. Capital, £5,000. Objects: To adopt an agreement with John McClure, Ltd., to acquire the sole selling and distributing rights of the products of that company, and to carry on the business of buyers, sellers and manufacturers of radio apparatus, gramophones, television apparatus, &c. J. E. C. McClure is first and permanent director. Secretary: G. F. Pyle, 105, Cheapside, E.C.2.

Turner & Booth (Southport), Ltd.—Private company. Registered February 26th. Capital, £400. Objects: To carry on the business of electrical engineers, wireless and mechanical engineers, &c. The directors are: E. W. Turner (permanent director and chairman), 114, Church Street, Radcliffe, and R. D. Millar, 25, Carnegie Street, Dunfermline, N.B. Registered office: 11, London Street, Southport, Lancs.

Modern Lighting, Ltd.—Private company. Registered February 22nd. Capital, £3,000. Objects: To carry on the business of electricians, electrical engineers, &c. J. C. A. Thomson, Lairg, Beverley Gardens, Hornchurch, Essex, is first director. Registered office: Hastings House, Norfolk Street, W.C.2.

Thermovent (1936), Ltd.—Private company. Registered in Edinburgh February 28th. Capital, £500. Objects: To acquire from G. B. Burnside, the benefit of certain existing patents and/or inventions relating to heating and ventilating by electrical means, &c. The directors are: G. B. Burnside, 1039, Argyle Street, Glasgow, and J. Grant, 113, St. Vincent Street, Glasgow. Registered office: 1039, Argyle Street, Glasgow.

Returns of Electrical Companies

Mid-Wales Electric Power Co., Ltd.—Particulars filed of £50,000 debenture stock, authorised December 12th, 1935, and covered by trust deed dated February 18th, 1936, charged on 16,700 £1 ordinary and 1,000 £1 5 per cent. cumulative participating preference shares (fully paid) in the Yale Electric Power Co., Ltd., and the company's undertaking and property, present and future, including uncalled and unpaid capital, the whole amount being now issued. Trustees: National Bank, Ltd.

Radio Rentals, Ltd.—Capital, £30,000 in 20,000 7½ per cent. cumulative preference shares of £1 and 50,000 ordinary shares of 4s. Return dated October 30th, 1935. 15,000 preference and 25,000 ordinary shares taken up. £20,000 paid. Mortgages and charges at date of return, £11,042 15s. Between December 19th, 1935, and January 15th, 1936, a further 5,000 preference shares were allotted, payable in cash and fully called up, and 25,000 ordinary shares were allotted as fully paid by way of "bonus."

Britannic Electric Cable & Construction Co., Ltd.—The nominal capital has been increased by the addition of £1,000 beyond the registered capital of £100. The additional capital is divided into 1,000 6 per cent. preference shares of £1 each.

Strand Electric & Engineering Co., Ltd.—The nominal capital has been increased by the addition of £36,000 in £1 shares beyond the registered capital of £24,000.

Pearce Signs, Ltd.—Capital, £2,700 in £1 shares. Return dated October 14th, 1935. All shares taken up. £2 paid, £2,698 considered as paid. Mortgages and charges, nil.

Bedford-Park Transmissions, Ltd.—Capital, £11,000 in 10,000 "A" shares of £1 and 20,000 "B" shares of 1s. Return dated December 31st, 1935. 3,919 "A" and 20,000 "B" shares taken up. £589 paid on 589 "A" shares, £4.330 considered as paid on 3,330 "A" and 20,000 "B "shares. Mortgages and charges, nil.

Erimus Electrical Factors, Ltd.—Capital, £500 in £1 shares. Return dated October 1st, 1935. 260 shares taken up. £260 paid. Mortgages and charges, nil.

A. J. Shrosbery & Co., Ltd.—Second debenture dated February 15th, 1936, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital (subject to 1st debenture dated December 28th, 1932). Holders: General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

Holdgate & Commin (Electrolier), Ltd.—Capital, £1,000 in 350 6 per cent. non-cumulative preference and 650 ordinary shares of £1 each. Return dated September 20th, 1935. 600 ordinary and 60 preference shares taken up. £600 paid, £60 considered as paid. Mortgages and charges, nil.

Gambrell Bros. & Co., Ltd.—Capital, £50,000 in 100,000 ordinary shares of 5s. and 25,000 preference shares of £1 each. Return dated December 31st, 1935. 55,420 ordinary and 11,500 preference shares taken up. £10,800 paid on 15,420 ordinary and 6,945 preference shares, £14.555 considered as paid on 40,000 ordinary and 4,555 preference shares. Mortgages and charges: £6,890.

Crypton Equipment, Ltd.—Debenture, dated February 12th, 1936, to secure all moneys owing or to become owing from the company to Lancashire Dynamo & Crypto, Ltd., Trafford Park, Manchester. Property charged: The company's undertaking and property, present and future, including uncalled capital.

R. J. Raphael & Co., Ltd.—G. C. Moody, 10, Coleman Street, E.C., was appointed receiver on February 13th, 1936, under powers contained in debenture dated March 26th, 1934.

City Notes

The Midland Counties Electric Supply Co., Ltd., held its annual meeting on March 2nd, when Mr. G. Balfour (chairman), who presided, before proceeding with the business of the meeting, referred with regret to the death of Mr. George Verity, a director. He went on to say that during the past year their operating companies had connected more consumers than the total connected to their services at January, 1928. Dealing with the transport business, he said that last year they arranged for the sale of the transport undertaking owned by their subsidiary, the Leamington & Warwick Electrical Co., Ltd. This company also owned the electric lighting Order in Warwick and this Order had been transferred to the Midland Electric Light & Power Co., Ltd., another of their subsidiaries. Turning to the supply business, he said that their stations continued to operate under the direction of the Central Electricity Board, which precluded them from fully developing the efficiency of the Avon power station. They still supplied energy at a loss to the Central Electricity Board. Under the 1926 Act selected station owners were promised benefits not burdens to pass on to the consumers, and they continued to hope that the Act would soon be amended to give effect to the definite assurances which induced Parliament to pass the Bill into law. An additional 28,000 kW was connected during the year, bringing the total load up to 250,000 kW. They "exported" 82,600,000 kWh to the Central Board, and "imported" 32,300,000 kWh. Apart from this and excluding any inter-company bulk supplies electricity sent out from their power stations amounted to 357,000,000 kWh, and the sales totalled 324,145,000 kWh, as compared with 262,500,000 kWh in 1934. Of the increase 26,500.000 kWh was supplied to consumers with exceptional power demands, and the increase due to their miscellaneous power and lighting business alone was 35,145,000 kWh. They added 16,734 new consumers, and the total to date was 92,294. According to the present outlook they should considerably exceed the 100.000 mark during the current year. The average price received from the sale of electricity by all their operating companies was 0.825d. per kWh. They were again reviewing all tariffs to see if any flaws existed which needed attention. They extended their supplies to twenty-nine parishes, and now supplied in three boroughs, thirty-one urban districts, and 522 rural parishes. They also inaugurated public lighting systems in thirteen additional parishes, and now supplied street lighting in two boroughs, seventeen urban districts, and 115 rural parishes. They added eighty-six miles of h.p. and 202 miles of l.p. mains, making the total to date 3,064 miles. Their transformer stations or points now numbered 1,235, being an addition during the year of 132.

London Electric Supply Corporation, Ltd.—Presiding at the annual meeting held on Tuesday last, Mr. O. R. H. Bury (chairman) said that the amount of energy sold last year was 343,207,758 kWh, as against 325,211,132 kWh in 1934, which constituted a record. The total number of consumers had increased by 3,181, and the connected load was, exclusive of the railway, 76,645 kW. The all-in business and domestic tariffs were resulting in a larger consumption by each consumer, while hire and hire-purchase terms had increased the use of domestic apparatus. Distribution cables had been extended by a further twenty-one miles in the residential area, and of this the greater portion was in roads where electricity had not been available. The assisted-wiring schemes introduced in 1933 had also been a success. The policy of revising tariffs so that the revenue received from the consumer was less than that which the company was entitled to receive under the 1925 Act had resulted in £93.000 being saved by the consumers during 1935. He referred to the position mentioned by Sir Francis Fladgate (chairman of the London Power Co.), in which his company had supplied electricity to the Central Electricity Board and, under the 1926 Act, was paid a price which did not include a fair proportion of the capital charges entailed in giving the supply, and said that their consumers were bearing a proportion of these charges which should be paid by those receiving their supply through the C.E.B. During the year they had increased the supply to the Southern Railway, the increase coming into operation from October 1st last. They were in no way responsible for the recent Southern Railway breakdown. The lighting of streets in Deptford had given satisfaction, and they had been requested by another borough, forming part of their statutory area, to submit a similar scheme, which was in course of preparation. During the last eight years sales had been more than doubled, but the resultant revenue had increased by only 22 per cent., due to a decrease of 41 per cent. in the average price charged to consumers.

The North Metropolitan Electric Power Supply Co. reports a net revenue for the year ended December 31st last of £794,825, as compared with £768.589 for the preceding year, to which is added £44,501 brought in, making £839.326. After deducting debenture interest, &c., and allocating £327.670 to depreciation and reserve account and £30,000 to contingency account, there is a balance of £384,863. It is proposed to pay a final dividend of 6 per cent. on the ordinary stock, making 10 per cent. for the year (same), and a dividend of 6 per cent. on the ordinary stock, issued in July last, leaving £49,862 to be carried forward. The capital expenditure during the year, mainly upon plant and machinery and trunk and distributing mains, amounted to £892.793. Approximately 232 miles of underground mains were laid and fifty-two miles of overhead lines were erected during the year, bringing the total up to 2.805 miles. New substations put into service totalled ninety-nine, making 764. The number of kWh supplied during the year totalled 495,200,000, an increase of 71.700.000 kWh, or 17 per cent., as compared with 1934. The number of consumers supplied either directly or indirectly was 296,606, as against 254.735. A supply was provided to thirty-three additional villages, and 1,403 additional street lamps were brought into use, raising the total to 11,022. New showrooms were opened at Harringay, Kingsbury, and South Chingford and extensions were carried out at Edgware and Hoddesdon showrooms. A new wing was added to Northmet House. Stockholders were offered £700,924 new ordinary stock in July last and £678,737 was taken up. In November last £625,000 3¼ per cent. debenture stock was created, all of

which has been issued and will rank for dividend as from January 1st. A Bill has been deposited in the present session of Parliament seeking powers to increase the authorised capital by £3,000,000, to extend the borrowing powers and for other purposes. The "follow on" charge for electricity under the all-in rate has been standardised at ½d. per kWh for both summer and winter months throughout the whole of the area.

The Telegraph Construction & Maintenance Co., Ltd., held its annual meeting on March 3rd when Mr. C. F. Campbell (chairman), who presided, in reviewing the balance sheet, said that on the credit side the value of freehold premises, steamships, machinery, plant and tools, at £474,319, showed a decrease of £65,470, as compared with 1934. The reason for this reduction was the sale of their submarine plant to Submarine Cables, Ltd., for £110,000. The new company had earned a definite profit in the first three months of its existence, namely, from October 1st to December 31st last. The outstanding feature of the year was the arrangement made with Messrs. Siemens Bros. with effect from October 1st for the amalgamation of that company's manufacturing interests and their own in submarine cable having insulation of a plastic material such as gutta percha. Submarine Cables, Ltd., was formed with a capital of £220,000 fully paid, half of the shares being held by them and half by Messrs. Siemens Bros. The new company had taken a lease of their submarine cable works at Greenwich, where these cables would be manufactured. They regarded this amalgamation as a matter of the greatest importance for the submarine cable industry. Manufacture was now centred entirely in one factory, so that great savings in overhead charges had been effected. Greater efficiency had been obtained and the expert knowledge of both companies was available for dealing with the use and production of submarine cables. A promising start had been made and several satisfactory orders had already been received. The Bass Strait cable manufactured by Siemens Bros. to carry the traffic between Australia and Tasmania had now been successfully laid. Inquiries were now being received for similar types and in future the manufacture of such cables as were ordered in Great Britain would be carried out in the new company's works at East Greenwich. The results of their power cable business had been satisfactory despite the prevalence of uneconomic prices for a large part of the year. Prices had now definitely improved and reasonable profits should be earned in the future. It must, however, be borne in mind that the power cable factory was only a single unit and also that they had not undertaken the manufacture of rubber cable. The Metallurgical Department which produced their patented magnetic and heat-resisting alloys, was kept satisfactorily occupied during the year and the sales tended to show that the use of these alloys in the electrical industry was steadily increasing. They had extended considerably during the year the scope of their special cables used for broadcast relay installations. They had been seriously concerned with the cost of maintaining the Selborne Plantation and the upkeep of the cable steamer *Dominia*, and it might be found desirable to dispose of the plantation. The *Dominia* had made only one voyage during 1935, and it was not desirable to keep a large ship of this kind continuously idle. The position regarding this cable ship had changed since the new company was formed as Messrs. Siemens Brothers' ship, the *Faraday*, was now available and was capable of laying most cables of normal length. Should a satisfactory offer be made for the *Dominia* they would probably decide to let her go, and in fact negotiations were now proceeding. In conclusion Mr. Campbell said that he believed that the company, after several years of great difficulty, had at last turned the corner.

Lancashire Dynamo & Crypto, Ltd.—Presiding at the annual meeting held on February 27th last, Mr. A. E. L. Chorlton (chairman), said that the figures for the past year showed a marked improvement on those submitted for the previous few years. In orders secured, sales effected, unexecuted orders carried forward, and in net profit, the results were very satisfactory. Internal reorganisation had been carried out at both factories, including the addition of new machine tools which had contributed largely to reduction in costs and increased output, and at the Willesden works further extensions had been made to give the extra accommodation required. During the year a new company had been formed known as Crypton Equipment. Ltd., with a nominal capital of £1.000. An agreement had been made with Messrs. J. Lucas, Ltd., by which they acquired the goodwill, designs, selling rights, &c., and such stocks as they required from Messrs. Rotax of that company's business dealing with Newton's garage equipment, and battery charging and cinema rectifiers. A new factory had been equipped and was now in operation, the results so far obtained being up to expectations. The shares were held by the parent company. Mr. J. G. Shaw, one of the original founders of the Crypto Co., had retired from active management but would continue as a director.

The Northampton Electric Light & Power Co., Ltd.—The report for the year ended December 31st last shows a gross revenue of £337,852, as compared with £313,479 in 1934. The net revenue was £110,347, which with the balance brought in (£12,352), income from investments and bank interest, makes £129,251. After deducting debenture interest, &c., and placing £10,000 to reserve it is proposed to pay a final ordinary dividend of 6 per cent., maintaining the distribution for the year at 10 per cent., and to carry forward £15,031. In May last 145,000 ordinary shares were issued to the ordinary shareholders at 44s. per share. Electrical energy sent out from the power station and sold to the Central Electricity Board totalled 97,624,710 kWh, an increase of 21 per cent. Sales to the company's own consumers and in bulk to its associated companies were 65,886,414 kWh, an increase of 12 per cent. The maximum load on the system was 27,145 kW. An extension of the generating station by the addition of a 30,000-kW turbo-alternator and other necessary plant has been in progress during the year and is now nearing completion.

The Rushden & District Electric Supply Co., Ltd., reports a net revenue for 1935 of £12,162, as compared with £12,570 in the preceding year, to which is added £2,160 brought in, making £14,322. After deducting debenture interest, &c., a final dividend of 4½ per cent. is proposed, making 8 per cent. for the year (same), and £2,205 is carried forward. The sales of electricity increased from 5,896,496 to 6,734,757 kWh.

Enfield Cable Works, Ltd., reports a profit for the year ended December 31st last of £143,357, as compared with £137,086 in the preceding year. After deducting directors' fees and depreciation, the net profit is £129,557, which with £25,350 brought in makes £154,906. It is proposed to pay a final ordinary dividend of 15 per cent., making 25 per cent., less tax, for the year, to place £10,000 to reserve, and to carry forward £29,906. The directors propose to capitalise £100,000, being part of the undivided profits, and to distribute it by way of bonus to the ordinary shareholders in the proportion of one new ordinary share for every four shares held.

The Metropolitan Electric Supply Co., Ltd., reports a gross revenue for 1935 of £1,260,780, as compared with £1,153,533, and a net revenue of £354,558, against £327,510, which, with the balance brought in, interest, &c., makes £664,163. It is proposed to pay a final ordinary dividend of 7 per cent., again making 10 per cent. for the year, leaving £143,215 to be carried forward. The death of Mr. G. H. Verity is regretted, and appreciation is expressed of the services rendered by him as a director for nearly twenty years. Meeting: March 10th.

Ismay Industries, Ltd., is offering to ordinary and preference shareholders 150,000 5½ per cent. cumulative first preference shares of £1 each at 20s. 6d. per share, and to ordinary shareholders only 340,000 ordinary shares of 5s. each at 7s. per share in the ratio of one new share for every five held. After the present issues have been subscribed the total issued share capital will consist of £250.000 in 5½ per cent. cumulative first preference shares and £510,000 in ordinary shares.

Charles Clifford & Co., Ltd., report a profit for 1935 of £17,144, as against £9,899 for the preceding year, which with £30,248 brought in makes £47,392. It is proposed to pay a final ordinary dividend of 1s. per share, making 10 per cent., tax free, for the year, and to pay a bonus of 1s. per share on the ordinary shares, tax free. Reserve receives £10,000, plant renovation reserve £5,000, and £21,592 is carried forward.

Companies Struck off the Register.—The names of the following companies have been struck off the Register and they are thereby dissolved:—Darimont Electric Batteries, Ltd.; Somac Electrical Heating Co., Ltd.; South Western Radio & Accessories Stores, Ltd.; United Electric Stores (Walworth), Ltd.; Wireless Apparatus, Ltd.

Clarke, Chapman & Co. report a net profit for 1935 of £41,859, as compared with £29,938 for the preceding year. Reserve receives £8,000 (against nil), and the ordinary dividend is 6 per cent. (against 5 per cent.), leaving £10,754 to be carried forward.

The Telephone & General Trust, Ltd., has declared a final dividend on the ordinary shares of 5 per cent., making 8 per cent. for the year, and a dividend of 8 per cent. on the "A" ordinary shares. These distributions are the same as for 1934.

The Mid-Southern Utility Co. is inviting stockholders to tender for £100,000 of 4 per cent. consolidated preference stock which the company is offering for sale. The minimum price is 106 per cent.

The Mid-Cheshire Electricity Supply Co. has declared a final dividend of 1s. 7½d. per share for the year on the old ordinary shares and 10⅝d. per share on the new ordinary shares, both less tax.

The Bournemouth & Poole Electricity Supply Co., Ltd., has announced a final dividend of 9 per cent. on the ordinary shares, making 15 per cent. for the year (unchanged).

The Newcastle & District Electric Lighting Co., Ltd., is maintaining the dividend on the ordinary shares at the rate of 7 per cent. for the year 1935.

Davis & Timmins, Ltd., are paying a final ordinary dividend of 5½ per cent., making 8 per cent. for the year (against 6 per cent.).

The Isle of Thanet Electric Supply Co., Ltd., has announced a dividend of 4 per cent. on the ordinary shares for 1935 (same).

Stocks and Shares

Tuesday Evening.

THE general course of the Stock Exchange markets, although chequered by cross-currents caused by foreign affairs, can reasonably be described as affording satisfaction to the holder of securities. During the past day or two the general atmosphere in the markets became lightened by hopes of an early peace being arranged between Italy and Abyssinia through the medium of pressure applied by agreement on oil sanctions. What may be the upshot of this theory, the next few days will probably reveal, but in the meantime it has given fresh encouragement to release of capital for employment in gilt-edged stocks and industrial shares. It may be said that no department in particular exhibits any outstanding features. Business is, however, well maintained on the whole, and public attention continues to take an active interest in the shares of the popular aircraft, armament and "defence" companies.

London Passenger Transport

The fixed-interest stocks of the London Passenger Transport Board are inclined to be heavy, but the "C" stock—the semi-speculative member of the group—is receiving a good deal of notice from the investor who likes to have money in a stock that carries the chance of improvement in dividend and, accordingly, in capital value. On this point, the speech

of the chairman of Thomas Tillings delivered at the annual meeting of the latter company last week, is particularly interesting. Tillings hold over one and a half million pounds of Transport "C" stock. The chairman pointed out that last year a dividend of 4 per cent. was paid, against a standard rate of 5 per cent. This year's standard rate is 5½ per cent., of which an interim of 2½ per cent. has already been paid. The chairman of Tillings maintains that with efficient management and a possible slight adjustment in fares, the full standard of 5½ per cent. could be paid out of earnings. He drew attention to the duties of the London Passenger Transport Board, as set out in the Act of 1933, more particularly with regard to the "C" stock.

Southern Railway and Electrification

Holders of shares in companies engaged in the supply of electrical equipment, will derive no little satisfaction from the recent meeting of the Southern Railway at which the chairman, Mr. Holland Martin, bore weighty testimony to the benefits which the company has received through electrification. "A large proportion of the increase in the company's passenger train receipts," said Mr. Martin, "is attributable to traffic on electrified lines, and this is the best reason for continuing the process of conversion of additional lines to electricity."

The Southern Railway is entitled to about six million pounds of the Government guaranteed 2½ per cent. Railway Finance loan. There can be no doubt that a good proportion of this amount will be spent on electrical equipment, to the advantage of the manufacturing companies and their shareholders. The chairman's speech, which struck a distinctly optimistic note, did much to steady the Home Railway market.

Electricity Supply Shares

In spite of encouraging announcements from official and other sources, the shares of electricity supply companies are not making headway. No stir in the market was caused by the publication of the Electricity Commissioners' annual report, with its evidence of the rapid and continuous expansion of electricity consumption in this country, and its emphasis on the accelerated rate at which consumption is increasing for industrial and domestic use. The market is similarly unaffected by a further batch of dividend announcements and reports, received from a number of the leading supply companies. In practically every case the dividend is maintained at the same rate as for previous years, and reports of increased output and revenue are general. Among such companies, the prices of Metropolitans and Clyde Valleys are little altered. North Metropolitans shed 2s. 3d. to 58s. 9d. ex dividend. North Easterns at 34s. 6d. and Yorkshires at 46s. 6d. have lost 2s. and 1s. respectively. City of Londons are 6d. lower at 39s.

Manufacturing and Equipment

Prices of shares in most of the companies that manufacture electrical equipment are fluctuating in undecided and irregular fashion. They gave way under the influence of the combination of disturbing developments in Europe and the Far East, but buyers were attracted by the lower levels and much of the lost ground was regained. General Electrics fell a further 1s. to 77s., but rebounded to 79s. 6d. Associated Electricals also sagged, but a subsequent rally left them with a net gain of 1s. 6d. on the week at 48s. 6d. The upward movement was assisted by anticipations of an increase to 8, or even 10 per cent. in the dividend to be announced shortly. Telegraph Constructions, at 30s., are 2s. 6d. higher. The recent report shows a good recovery in the company's earnings, but the price dropped to 26s. before the revival occurred. The company has paid no dividend since 1930, when 7½ per cent. was distributed. The announcement by the Enfield Cable company of a repetition of the previous year's cash dividend of 25 per cent., plus a scrip bonus of one new share for every four old shares held, was in accordance with the market's anticipations and did not affect the price of the shares, allowing for deduction of the dividend.

Among other cable manufacturers, British Insulateds and Johnson and Phillips fell 2s. 6d. and 1s. 9d. to 101s. 3d. and 47s. respectively. Electric Constructions are dull at 36s. 3d. Crompton Parkinsons have come strongly into favour again. Ericssons at 2½ are 1/16 harder.

Miscellaneous Matters

Cable and Wireless stocks are further subdued by the uncertainty of the international outlook. The 5½ per cent. preference has fallen 1½ to 109, the "A" stock ½ to 28½, and the "B" stock ¼ to 8½. Internationals are the subject of alternate enthusiasm and depression. Prices are subject to wide fluctuation. Brazil Tractions are unchanged on balance at 14⅜. Hydro Electric gained ⅛ to 8¼, and International Holdings ¼ to 2⅜. American Telephone and Telegraph dropped another point to 171½. Marconi-Marines fell 1s. 3d. to 35s. Rumours of a dissolution of the Radio Manufacturers' Association and of the imminence of a price-cutting "war" among manufacturers, produced a sharp fall in the shares of companies concerned, before a denial of the report restored confidence. E. K. Coles relapsed 2s. on the report, but have recovered most of the loss at 26s. 3d. Electric and Musical Industries were similarly influenced. At 27s. 9d. the shares are 6d. lower on the week. British Vacuum Cleaner shares, in their new 5s. form, are 3/16 lower at 1⅜, and the new preference shares, which are 10s. paid, fell 3d. lower to 9d. premium.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Dividend. 1933.	Dividend. 1934.	Price Mar. 3	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	3⅛	—	3 16 2
City of London	1	7½	7½	39/–	–6d.	3 17 0
Clyde Valley	1	7	8	46/–	—	3 9 7
County of London	1	10½	10½	56/6xd.	–3d.	3 14 4
Edmundson's 7% Pref.	1	7	7	36/6	—	3 16 9
Do. Ord.	1	7	8	45/6	—	3 10 4
Elec. Dis. Yorkshire	1	9	9	48/–	—	3 15 0
Elec. Fin. and Securities	1	12½	12½	3 7/8	—	3 12 9
Elec. Supply Corporation	1	11	11	65/9	—	3 7 0
Lancs Light and Power	1	7½	7½	39/–	—	3 17 0
Lond. Assoc. Electric	1	—	—	35/6	—	3 19 0
London Electric	1	7	8	40/–	—	4 0 0
London Power Deb. Red.	Stock	5	5	108½	—	4 12 2
Metropolitan	1	10	10	52/6xd.	–3d.	3 16 1
Midland Counties	1	7	7½	40/–xd.	–3d.	3 10 3
Mid. Elec. Power	1	8	8	42/6	—	3 15 3
North Eastern Electric Ordinary	1	6	6	34/6	–2/–.	3 9 8
Do. 7% Pref.	1	7	7	35/6	—	3 19 0
Northampton	1	10	10	53/9	—	3 14 5
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	58/9xd.	–2/3.	3 8 0
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	43/9	—	3 13 2
South London	1	7	7	35/–	—	4 0 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	46/6	–1/–.	3 8 10

Public Boards.

Central Electricity 1950–70	Stock	5	5	116	—	4 6 2
Do. 1955–75	,,	5	5	119xd.	+1	4 4 0
Do. 1951–73	,,	4½	4½	112	—	4 0 4
Do. 1963–93	,,	—	3½	104	—	3 7 4
London Elec. Trans. Gtd.	,,	—	2½	96½	—	2 11 10
London & Home Counties, 1955–75	,,	4½	4½	113	+1	3 19 8
London Passenger Transport, A.	,,	—	4½	125½	–1	3 11 9
Do. do. B.	,,	—	5	128½	–1	3 17 10
Do. do. C.	,,	3½	4	106	+½	3 15 6
West Midlands Joint Elec. 1948–68	,,	—	5	116¼xd.	+2	4 5 10

Telegraph and Telephone.

American Tel. & Tel.	$100	9	9	171½	–1	5 4 4
Anglo-Am. Tel. Pref.	Stock	6	6	125½	—	4 15 7
Do. Def.	,,	1½	1½	30	—	5 0 0
Cable & Wireless 5½% Pref.	,,	2¾	4½	109	–1½	3 15 8
Do. A. 7½% Ord.	,,	Nil	Nil	28½	–½	—
Do. B. Ord.	,,	Nil	Nil	8½	–½	—
Globe Tel. & Tel. Ord.	10	2½	3½*	16¼xd.	+1/8	2 3 4
Do. do. Pref.	10	6	6	14½xd.	–¼	4 4 3
Great Northern Tel.	10	20	20	43	+½	4 13 0
Marconi-Marine	1	10	7½	35/–	–1/8	4 5 9
Oriental Telephone Ord.	1	12	12	3¼	—	3 13 10

Home and Foreign Trams, etc.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/3	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	6	—	—
British Electric Traction Df. Ord.	,,	5	5	1565	–10	—
Do. do. Pref. Ord.	,,	8	8	179½	+2	4 19 2
Brazil Traction	100	—	—	14⅜	—	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	98½	—	5 1 6
Mexican Light Common	100	Nil	Nil	3½	—	—
Do. 7% Pref.	100	7	7	7½	—	—
Do. 1st Bonds	$500	5	5	57½	—	—
Victoria Falls Ord.	1	20	20	3⅛	+1/8	—
West Riding	1	5	6½	52/6	—	2 9 6

Manufacturing Companies.

Aron Electricity Ord.	1	10	15	66/3	—	4 10 7
Assoc. Elec. Ord.	1	4	6	48/6	+1/6	2 9 6
Do. Pref.	1	8	8	39/–	—	4 2 1
Babcock & Wilcox	1	6	8	55/–	+1/–	2 18 3
British Aluminium Ord.	1	5	7½	46/3	—	3 4 10
British Insulated Ord.	1	5	15	5 1/8	–⅛	2 19 3
Brush Ord.	Stock	Nil	Nil	44	—	—
Callender's	1	15	15	4½	—	3 12 10
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord.	5/–	—	12½	67/6	+⅛	0 7 6
Do. 8% Pref.	1	8	8	38/9	—	4 2 7
Edison Swan 1st Pref.	1	7⅛	7⅛	30/–	—	5 0 0
Electric Construction	1	Nil	3½	1⅜	–1/8	1 18 8
Enfield Cable Ord.	1	25	25	6¾xd.	—	3 18 5
English Electric	1	Nil	Nil	1	+1/–	—
Do. do. Pref.	1	Nil	Nil	22/6	–6d.	—
Ericsson Tel.	5/–	—	24	42/6	+⅛	—
Ever Ready	5/–	35	35	24/6	—	7 2 10
Ferranti Pref.	1	7	7	26/3	—	5 6 8
G.E.C. Pref.	1	6½	6½	34/–	—	3 16 6
Do. Ord.	1	8	10	79/6	+1/6	2 10 6
Henleys	1	30	30	7½	—	4 0 0
Do. 4½% Pref.	5	4½	4½	5⅛	—	3 18 3
India-Rubber Preferred	1	—	5⅛	1⅛	—	4 17 9
Johnson & Phillips	1	5	7½	47/–	–1/9	3 3 10
Siemens Ord.	1	6½	4	28/9	—	2 15 8
Telegraph Construction	£1	Nil	Nil	30/–	+½	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

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9371. "Method of and means for attaching paste to the plates of electric batteries." F. MacCallum and A. H. Redfern. April 26th, 1934. (442281.)

13124. "Permanent magnets." Marrison & Catherall, Ltd., and A. C. Catherall. May 1st, 1934. (442127.)

15884. "Electric current converting arrangements, particularly for high-voltage rectification." British Thomson-Houston Co., Ltd. May 27th, 1933. (442280.)

17575. "Electric transformers." H. Clark. October 26th, 1934. (442282.)

19515. "Electric cable conduits." J. B. Mercer and Broughton Copper Co., Ltd. July 2nd, 1934. (442134.)

19700. "Coin collectors for telephone systems." F. W. Hall and Hall Telephone Accessories (1928), Ltd. July 4th, 1934. (Cognate application 4255/35.) (442432.)

19740. "Electric contact members and means for fixing such members to carriers or supports." Callender's Cable & Construction Co., Ltd., and W. F. Slater. July 4th, 1934. (442216.)

19775. "Remote-control of time-indicating devices." E. H. W. Weilbull. July 5th, 1934. (Convention date not granted.) (442283.)

19825. "Electron-discharge devices and circuit arrangements embodying such devices for the amplification of electric variations." S. Rodda. July 5th, 1934. (442285.)

19920. "Voltmeter arrangements." Marconi's Wireless Telegraph Co., Ltd., and L. M. Myers. July 6th, 1934. (442368.)

20018. "Electron-discharge tubes, indirectly-heated cathodes therefor, and methods of making same." L. L. De Kramolin. July 7th, 1934. (442436.)

22214. "Mechanical and electrical couplings." A. F. W. Richards and H. Bright. July 30th, 1934. (Cognate application 14609/35.) (442140.)

22499. "Electric lampholders and caps." J. M. S. Camderá and M. F. de C. Cuadrado. January 29th, 1934. (Cognate application 22500/34.) (442374.)

22551. "Protective arrangements for booster transformers." British Thomson-Houston Co., Ltd., and P. Mathews. August 2nd, 1934. (442150.)

22552. "Electric cooking stoves." Hotpoint Electric Appliance, Ltd., and J. Wetherell. August 2nd, 1934. (442151.)

22555. "Electrical testing instruments." Metropolitan Electric Supply Co., Ltd., and E. C. T. Oldcorn. August 2nd, 1934. (442225.)

22622. "Fusible electric cut-outs." J. A. Crabtree. August 3rd, 1934. (442375.)

22652. "Tuning-indicators for radio receiving apparatus and the like." R. H. Hacker and A. G. Hacker (trading as H. Hacker & Sons). August 3rd, 1934. (442158.)

22682. "Induction electric furnace installations." S. G. H. B. King, M. J. Marchbanks, and Associated Electrical Industries, Ltd. August 3rd, 1934. (442376.)

22683. "Diesel-electric generating sets." P. C. Saccaggio. August 3rd, 1934. (Cognate application 23680/34.) (442162.)

22720. "Directional wireless systems." Marconi's Wireless Telegraph Co., Ltd., and S. B. Smith. August 3rd, 1934. (442164.)

22726. "Loudspeakers." G. F. Dutton. August 3rd, 1934. (442165.)

22780. "Photophones." C. Zeiss. August 17th, 1933. (442228.)

22811. "Manufacture of permanent magnet assemblies." Swift, Levick & Sons, Ltd., and G. D. L. Horsburgh. August 7th, 1934. (442442.)

22899. "High-frequency transmission systems for the transmission of signals along high-potential lines." Siemens-Schuckertwerke, Akt.-Ges. August 21st, 1933. (Cognate application 22900/34.) (442446.)

22904. "Light current electric switches." S. Whyte, W. J. Brown and A. M. Hallawell. August 7th, 1934. (442448.)

25349. "Systems of electric motor control." British Thomson-Houston Co., Ltd. September 2nd, 1933. (442168.)

26226. "Means for transmitting or collecting electric current to or from a rotating axis." E. G. Hartel. September 12th, 1934. (442169.)

26953. "Electrical musical instruments." General Electric Co., Ltd., and S. K. Lewer. September 19th, 1934. (442379.)

27643. "Apparatus for influencing a beam of light by electrical means." K. Pulvari-Pulvermacher. November 30th, 1933. (442381.)

27674. "Electric tumbler switches." J. B. Tucker. September 27th, 1934. (442302.)

29006. "Radio and like rediffusion systems." Standard Radio Relay Services, Ltd., and F. Adorjan. October 10th, 1934. (442384.)

29031. "Gas-filled electric incandescent lamps." Egyesúlt Izzólámpa es Villa Mossági Reszvennetarsasag. October 10th, 1933. (442172.)

29045. "Electric lamps." A. S. Cachemaille (Universag Technische Akt.-Ges.). October 10th, 1934. (Convention date not granted.) (442307.)

29449. "Electric boiling or cooking vessels." T. Stiebel. October 15th, 1934. (442242.)

30152. "Key-operated electric switches, and switches combined with valves, particularly for use on motor vehicles." T. A. Tisdell, W. Rae, and Amal, Ltd. October 20th, 1934. (Cognate applications 7045/35 and 8184/35.) (442387.)

31776. "Electrical devices for automatically interrupting radiation." C. H. F. Müller, Akt.-Ges. November 6th, 1933. (442389.)

33971. "Combination setting and combination-change mechanisms for telegraph keyboard apparatus." R. G. Griffith. November 26th, 1934. (442177.)

34936. "Filters for electric wave transmission systems." Pye Radio, Ltd., and J. W. Dalgleish. December 5th, 1934. (442392.)

36662. "Electrical oscillation generator arrangements." Marconi's Wireless Telegraph Co., Ltd. December 21st, 1933. (442465.)

1935

2090. "Snap switches combined with adjustable resistances." Stackpole Carbon Co., and C. J. Hathorn. January 22nd, 1935. (442322.)

3321. "Apparatus for receiving television and the like." General Electric Co., Ltd., and L. C. Jesty. February 1st, 1935. (442323.)

4141. "X-ray tubes." British Thomson-Houston Co., Ltd. February 9th, 1934. (442324.)

4983. "Circuit arrangements for thermionic valves." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken Meaf. February 23rd, 1934. (442326.)

8091. "Electric-discharge lamps." General Electric Co., Ltd. March 28th, 1934. (442400.)

9521. "Synchronisation method for television." Radio Akt.-Ges. D. S. Loewe. March 31st, 1934. (442333.)

10111. "Electrical oscillation generators." Marconi's Wireless Telegraph Co., Ltd. (A. W. Vance). April 1st, 1935. (Convention date not granted.) (442334.)

11442. "Automatic switches of the step-by-step type such as are used in automatic telephone systems." Standard Telephones & Cables, Ltd. June 20th, 1934. (442335.)

12164. "Superheterodyne receiver for wireless reception." Hazeltine Corporation. May 22nd, 1934. (442477.)

13839. "Double current telegraph installations." Nationale Telephon und Telegraphenwerke Ges. May 19th, 1934. (442192.)

14407. "Electric signalling systems." Standard Telephones & Cables, Ltd. May 26th, 1934. (442342.)

16597. "Directive wireless signalling." C. Lorenz, Akt.-Ges. May 17th, 1935. (Addition to 405727.) (442193.)

16619. "Electric resistances having a negative temperature coefficient." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 31st, 1934. (442348.)

17251. "Cooling of electrical spark gaps or arcs." Allgemeine Elektricitäts, Ges. June 14th, 1934. (442194.)

18458. "Electric lampholders." F. Kniveton. June 27th, 1935. (442350.)

19140. "Electron-discharge devices." Telefunken Ges für Drahtlose Telegraphie. July 4th, 1934. (442196.)

19650. "Selectors for telephone systems." C. E. Every Clayton. (Nationale Telephon und Telegraphenwerke Ges.). July 9th, 1935. (442353.)

20782. "Electric plugs, sockets, adapters and the like." W. Dabscheck. July 22nd, 1935. (442197.)

21583. "Receiving arrangements for television systems." C. Lorenz, Akt.-Ges. August 1st, 1934. (442408.)

21878. "Photographic objective shutter assemblies for cameras employing photoelectric exposure-meters." Zeiss Ikon, Akt.-Ges. August 1st, 1934. (442409.)

22003. "Bulbs for oscillograph tubes such as Braun tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 17th, 1934. (442411.)

23491. "Grid-controlled electric discharge rectifiers." British Thomson-Houston Co., Ltd. August 24th, 1934. (442414.)

25705. "Sparking-plug for internal-combustion engines." G. Ruthardt. September 16th, 1935. (442421.)

26655. "Arrangements for supporting electrodes in electric discharge devices." British Thomson-Houston Co., Ltd. September 28th, 1934. (442422.)

27076. "Permanent magnets." Marrison & Catherall, Ltd., and A. C. Catherall. May 1st, 1934. (Divided out of 442127.) (442202.)

28063. "Tiltable searchlights having a high power arc-lamp." C. Zeiss. October 20th, 1934. (442488.)

28765. "Double current telegraph installations." Nationale Telephon und Telegraphenwerke Ges. May 19th, 1934. (Divided out of 442192.) (442278.)

31945. "Permanent magnets." F. Krupp Akt.-Ges. January 28th, 1935. (442490.)

35402. "Cathode ray tubes." Radioakt. Ges. D. S. Loewe. June 10th, 1933. (Addition to 421050.) (Divided out of 17112/34.) (442427.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 26th :—

Smoot Control (lettering and design). No. 563628. Class 8. Apparatus for controlling automatically the temperature and pressure of steam and the like in boilers, and for controlling automatically the quantity of air, fuel and the like supplied to boilers.—Electroflo Meters Co., Ltd., Abbey Road, Park Royal, N.W.10.

Meritus (lettering and design). No. 564032. Class 8. Electric transformers, valve rectifiers and battery charging apparatus.—Meritus (Barnet), Ltd., 36, Wood Street, Barnet, Herts.

Mercury and Lightning (design only). No. 564298. Class 8. Apparatus adapted both for transmitting and receiving wireless signals.—Transreceivers, Ltd., 444, Ewell Road, Surbiton.

Simms (lettering and design). No. 564415. All goods in Class 8.—Simms Motor Units, Ltd., Percy Buildings, Gresse Street, Rathbone Place, W.1.

Rex. No. 564814. Class 13. Rotatable electric switches (ordinary) for use with wireless and television receiving and transmitting apparatus.—A.B. Metal Products, Ltd., 9-12, Oval Road, N.W.1.

Sombrero. No. 564588. Class 16. Electrical insulators made of porcelain.—Bullers, Ltd., 6, Laurence Pountney Hill, E.C.4.

Elvee (lettering and design). No. 564669. Class 50. Lampshades made principally of celluloid.—Lucie Vordenbaumen, 22, Belsize Avenue, N.W.3.

Interohm. No. 565851. Class 50. Electrical insulating varnishes and electrical insulating substances of asbestos, mica, resin, oils or bitumen.—Interohm Electrical Insulators, Ltd., 31 & 32, Grosvenor Place, S.W.1.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barking.—Houses and flats, Blake Avenue; borough engineer. Houses (159), Manor estate; Leftley Bros., Ltd., Longbridge Road. Municipal offices; H. C. Lanchester, assessor. Extension to factory, Alfred's Way; Dicky Bird, Ltd., 79, Blackhorse Road, London, E.17.

Barnstaple.—Two schools, for E.C.

Barrhead (RENFREWSHIRE).—Houses (300); burgh surveyor.

Becontree.—Joinery factory, Oxlow Lane; F. R. Hipperson & Son, Ltd.

Bedford.—Houses (168), London Road; C. H. Blakeway, borough engineer.

Bedwellty.—Houses (100); U.D.C. surveyor.

Berkhamsted.—Houses (88), Highfield estate; U.D.C. surveyor.

Birkenhead.—Houses (24), Borough Road; Lloyd & Cross, Ltd.

Birmingham.—R.C. schools for the Church of St. Hubert, Wolverhampton Road; V. S. Peel, architect, Bennetts Hill, Birmingham.

Bolton.—Extensions to Lincoln mills, Washington Street; R. Entwistle & Co., Ltd. Extensions to Town Hall; Bradshaw Hope & Gass, architects.

Bromley (KENT).—Baths, with buffet, &c.; H. Cliffe, borough engineer.

Bursiem.—Houses (32), Liverpool Road; J. Thompson.

Carshalton.—Houses (100), Cottage Farm estate; U.D.C. surveyor.

Chelmsford.—Swimming baths, Victoria Road (£16,000); Parks Committee. Schools, for borough E.C.; H. W. Allardyce, architect. Extensions to factory; Marconi's Wireless Telegraph Co., Ltd.

Chorley.—Houses (1,500), Duxbury Park estate; W. R. Davidge, architect, 67, Blackheath Park, London, S.E.3. Cinema, Bolton Street, for D. Forrester, Cross Street, Manchester (£22,000).

Cuckfield (SUSSEX).—Houses (30), Lindfield; R.D.C. surveyor.

Derbyshire.—Elementary school, Staveley Avenue, Derby; G. H. Widdows, county architect, County Offices.

Devonshire.—Extension to Hawkmoor Hospital (£31,000) for the Devon Public Health Committee.

Dewsbury.—Senior schools, Bank Top; director of education.

Doncaster.—Rebuilding of railway station (£250,000); The London and North Eastern Railway, King's Cross, London, N.1.

Dumbartonshire.—County buildings, Dumbarton (£105,000); county clerk, Dumbarton.

Dumfries.—Houses (110). Nithside (electrical work); R. S. Osborne, burgh surveyor.

Durham.—Schools, Consett (£35,000), and Pittington, and additions to Spennymoor Alderman Wraith Secondary School (£24,250); F. Willey, county architect, 34, Old Elvet, Durham.

Epsom.—Houses (50), Downs Road, for A. J. Patterson.

Essex.—Extensions to Oldchurch Hospital Nurses' Home, Romford (£34,802), for C.C.; J. Stuart, county architect, Chelmsford. Institutions, Chadwell Heath and Dagenham; county architect, Chelmsford.

Eton.—Houses (22), Wraysbury; Cain & Co., builders, Hounslow.

Finchley.—Trolley bus depôt, Woodbury Grove; London Passenger Transport Board, 55, Broadway, Westminster, London, S.W.1.

Gourock.—Houses (96), Copper Mine Field; Alex. Duthie, burgh surveyor, Municipal Buildings.

Grantham.—Houses (54), Harrowby Hall estate, for the Land Settlement Association, Ltd.; Rudd & Son, Ltd., builders.

Hanley.—Houses, Birchgate estate and Peel Street; H. Clowes. Cinema, Leek Road; Wood & Goldstraw.

Herne Bay.—Houses (74), Dence Park estate, for Evelyn; H. Twigg.

Hertfordshire.—Modern school, Watford, and technical school, Little Cassiobury; director of education, Hertford.

Hull.—Extensions to works, Tadman Street; T. J. Smith & Nephew, Ltd.

Ince-in-Makerfield.—Houses (34), Winifred Street site; P. Fairclough, U.D.C. surveyor.

Irvine.—Houses (56), electrical work; John L. Yule, architect, Bridgend.

Isle of Ely.—Home for the Mentally Defective (120 beds); Mental Deficiency Committee.

Iver (BUCKINGHAMSHIRE).—Houses (140), Iver Heath, for Henry Boot (Garden Estate), Ltd.

Kent.—School, Castlecombe Road, Mottingham; county architect, Maidstone.

Lancaster.—Central bus station, Damside Street; borough engineer.

Leavesden (HERTFORDSHIRE).—Laundry, for the Co-operative Society.

Leeds.—Schools, Coldcotes; F. Broadbent, architect, Civic Hall.

Liverpool.—Offices, Canning Place (£20,000), for the National Union of Seamen. Secondary school, Mill Lane, for E.C.

Lochgelly.—Houses (232) in the next three years; Alex. Lumsden, burgh surveyor, Town House, Lochgelly.

London.—(BETHNAL GREEN).—Tenements, Waterloo House site (£29,992); R. J. Rowley, Ltd., Belmont Works, Belmont Avenue, London, N.17. (E.).—Extension to tobacco factory, for Godfrey Phillips & Co., Ltd., Commercial Road, E. (ISLINGTON).—Dwellings, Tufnell Park Road (£75,000); L.C.C. architect. (PECKHAM).—Dwellings, Rye Hill Park (£36,000); L.C.C. architect. (STOKE NEWINGTON).—Cinema for the Associated British Picture Corporation, Ltd., Film House, Wardour Street, W.1.

Macclesfield.—Houses (183), Moss estate; Sims, Sons & Cooke, Ltd., Nottingham, builders.

Maidstone.—Houses and shops, Sheals Court estate, for N. L. Smith. Houses (21), Cherry Grounds estate, for O. K. Whatley.

Malvern.—Cinema, Malvern Link; Capt. Roy Lambert, Malvern Theatres, Ltd.

Manchester.—Houses (6,000), Bowlee estate; city engineer.

Middlesbrough.—Town hall buildings and library, and extensions to the Constantine Technical College for E.C.; borough engineer.

Mildenhall.—Houses (48); R.D.C. surveyor, King Street.

Morecambe.—Houses (30), Old golf links; S. Carter.

Newcastle-on-Tyne.—School, Henry Street and Albert Street, for the managers of the Christ Church School; C. S. Errington, architect, 46, Grainger Street.

North Shields.—Houses and flats, Verne Road; S. Pye, builder, 115, Verne Road.

Oldbury.—Bus depôt and offices, Birchfield Lane; Birmingham & Midland Bus Co., Ltd. Three schools, Moar Farm estate, for E.C.

Ossett (YORKSHIRE).—Houses (67), Town End, for S. B. Nettleton, Market Place.

Penrith.—Houses, near Weatherriggs Rise; J. Laing & Sons, builders, Dalston Road, Carlisle.

Pontefract.—Maternity or children's hospital (£65,000), under will of Mr. W. H. Hydes; Infirmary Committee.

Prescot.—Hotel, Liverpool Road; Alfred Ernest Shennan, architect, North John Street, Liverpool.

Richmond (SURREY).—Extensions to Mogden Hospital (£103,821); E. D. Winn & Co., Ltd., builders, Halkin Place, London, S.W.1.

Rowley Regis.—Houses (394); borough surveyor. Houses (132), Tividale, for A. & J. Mucklow.

Salford.—Houses, Duchy and Summerville estates (£70,227); Leyland Construction Co., Ltd.

Saltcoats.—Houses (314); burgh surveyor.

Sheffield.—Houses (20), Newlands Grove; J. H. Naylor & Sons. Houses (109), Northcote Road; A. Ramsay. Houses (362), Parson's Cross estate (£114,922); M. J. Gleeson, Ltd. Houses (56), Ripley Street; D. Topliss. Houses and shops near Yorkshire Bridge Inn, Bamford, for the Derwent Water Board, Bamford, near Sheffield; Thomas Wilkinson & Sons (Builders), Ltd., Olive Grove Works, Sheffield. Large garage for Kennings, Ltd., Mappin Buildings, Norfolk Street; F. W. Tempest, architect, Market Chambers, Mansfield. Offices, showrooms and demonstration hall (£250,000) for the Sheffield Electricity Committee

Sidcup.—Houses, Hurst Farm estate (110 acres); New Ideal Homesteads, Ltd. Factory, for Supervents, Ltd., Wallis Works, Bower Road, E.9.

Slough.—Houses and flats, Woodland estate, Farnham Road, for Hayes Bridge Estate, Ltd. Houses (60), near Bath Road, for Salt Hill Estates, Ltd.

South Shields.—Junior and infants' school, Cleadon, for E.C.; J. H. Morton & Sons, architects, Martins Bank Chambers, Fowler Street, South Shields.

Stirling.—Cinema (1 800 seats). Allan Park, for the Stirling Cinema and Variety Theatres, Ltd.

Stockport.—Cinema, Wellington Road South (electrical work); Drury & Gomersall, architects, Imperial Buildings, Oxford Road, Manchester.

Stoke-on-Trent.—Houses (115), Dairyfields estate, Sneyd Green; E. Leake & Co. Extensions to Saggar works; Mintons, Ltd.

Tottenham.—Factories, Princes Street and Queen Street; Seymour Couchman, Ltd. Extensions to factory, High Road; J. Rawson, Ltd, 570a, High Road, London, N.17.

Trowbridge.—Houses (124), Mortimer Street; U.D.C. surveyor.

Tynemouth.—Branch premises, Front Street, for Laws Stores, Ltd.; J. W. Corking, architect, 16, West Street, Gateshead-on-Tyne.

Wakefield.—Houses (28), Thornes estate; borough architect.

Walsall.—Houses (1,000), Park Farm estate; Hodge Hill Estates, Ltd., Alum Well Road, Walsall Hill.

Walton-on-Thames.—Factory, for the Amalgamated Dental Co., Ltd., 5, Broad Street, London, W.1.

Weston-super-Mare.—Houses (70), Milton Road; Councillor George Sprake.

West Riding.—Schools, Dodsworth, Guiseley and Yeadon, Mirfield, Pateley Bridge, Penistone and Thurlstone, and Sherburn; director of education, Wakefield.

West Sussex.—Schools, Bognor Regis; Evan T. Davis, director of education, Chichester.

Wiltshire.—Extensions to Pewsey Mental Colony, including nurses' home (£40,000), for C.C.; T. Walker, county architect, Trowbridge. Senior school, Frome Road, Trowbridge; director of education. Trowbridge.

Witney.—Houses (28); R.D.C. surveyor, Blanket Hall.

Wolverhampton.—Block of shops and showrooms at the corner of Dudley Street, for Horton's Estate, Ltd., 31a, Colmore Row, Birmingham (£40,000), with electrical work; G. A. Boswell, architect, Wolverhampton.

Wood Green.—Factory for Barratt & Co., Ltd., Clarendon Road; A. Leitch & Partners, architects, 66, Victoria Street, London, S.W.1.

Worcester.—Houses (58), Tunnel Hill housing site (£20,950); Thomas Barker & Sons, Loughborough.

Worthing.—Houses (52), Lancing; R.D.C. surveyor.

York.—Houses (20), Langdale Avenue; R. A. Cattle. Hospital, Huntington Road; city architect.